JPRS-EST-88-011
20 OCTOBER 1988

FOREIGN BROADCAST INFORMATION SERVICE

JPRS Report

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ADVANCED MATERIALS

Aerospatiale, Hercules Sign Accord on Materials R&D

3698A307 Paris LA LETTRE HEBDOMADAIRE DU GIFAS in English 14 Jul 88 p 2

[Report entitled "Cooperation for Future Materials"]

[Text] The Aerospatiale and Hercules Companies, respectively represented by Jean Charles Poggi, Director of the Strategic and Space Systems Division, and Edward J. Sheehy, Chairman of Hercules Aerospace, have signed an agreement for intensifying already existing cooperation between the firms. Under the agreement, the two groups will be working together on the development of materials capable of resisting high temperatures. Results of the project will be suitable for industrial applications and future aerospace programs. In 1984, Hercules chose the automatic 3-D weave process developed by Aerospatiale. Since then, Hercules has greatly expanded applications and has made many parts based on the system, while expanding production factilities. The Aerospatiale Company is a world leader in aeronautical and space products and is represented in more than one hundred countries with its aeronautical and space products. Aerospatiale thus continues its policy of international cooperation, developed through such large scale programs as Airbus, Ariane, and Hermes.

AEROSPACE, CIVIL AVIATION

EC Plans Research Program for Aviation Industry

3698M507 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 482, 29 Jun 88 pp 12-13

[Text] The EC Commission is now preparing a joint research program for the aviation industry. After a 2-year pilot phase, the new EC program will presumably be implemented in 1991. Its purpose is to give the aviation industries of the 12 member nations new impetus to strengthen their competitiveness in the world market.

On the basis of a study worked out by the European industry, the EC Commission has now presented a report on the present situation and future prospects of this sector. In this report the commission points out the past successes of the European aviation industry (such as the Airbus), but does not keep silent about the considerable lag in research at the European enterprises as compared to the competition from third countries. In the opinion of the experts in Brussels, the Community's aviation enterprises should work more closely together than before.

The aviation industry is of vital interest to the governments of the 12 member nations and to the Community primarily since, in addition to aircraft for civilian traffic, European companies produce military aircraft as well. At present this sector employs about 500,000 persons throughout the EC. More than 200,000 of them are in Great Britain, nearly 130,000 in France and about 80,000 in the FRG. The 30-billion-ECU annual turnover of the European aviation industry corresponds to more than two-thirds of the EC budget. Thirty percent of that comes from EC exports to third countries.

At first glance these figures appear to confirm the clear upward trend of the past years. Since the beginning of the 1970's, European aircraft builders have been able to expand their share of the world market from 5 to 25 percent. The Airbus is only one example of the successful cooperation between EC companies. Cooperation agreements across the borders have also been reached in the field of military aircraft and military helicopters.

However, in its report the EC Commission warns against exaggerated optimism. In 1985, the European aviation industry employed 2,7 times fewer people than the companies of the—less populous—United States. At the same time, the turnover of the EC companies turned out 3.3 times lower than for the U.S. competition.

The EC experts indicated that they are particularly worried about the development of government contracts and research projects both on this and the other side of the Atlantic. Since the beginning of the 1980's the volume of government contracts in the United States has grown faster than in the Community. Government contracts provide essential support for the companies in question. In 1985 government contracts accounted for 67 percent of the turnover of the U.S. aviation industry. In the Community of 12 the figure during the corresponding period was only 35 percent.

With respect to research projects as well, the gap between the European enterprises and the U.S. competition has widened, according to statements by the EC Commission. In 1985, U.S. companies spent 23 percent of their revenue on research purposes, while the Europeans let it go at only 15 percent.

In order to be able to assert itself in the world-wide technological competition, the European aviation industry must exhaust the available research resources and financial means. The competitive battle is becoming increasingly harsh, and the number of potential customers is limited. In addition to the existing international cooperation in the field of production, in the future aircraft builders should therefore join forces in research as well and cooperate more extensively with universities and small and medium-sized enterprises. According to information by the EC commissioner responsible for industrial and research policy, Karl-Heinz Narjes, the European companies have already signalled their readiness. The commission will try to obtain support totalling about 60 million ECU in the coming year. A more extensive Community program can follow later.

11949

European Transonic Wind Tunnel Established in Cologne

3698m437 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 479, 13 May 88 p 12

[Text] Speaking at the foundation of the European Transonic Wind Tunnel GmbH [ETW] based in Cologne, the minister for research, Riesenhuber, referred to the great importance of the European transonic wind tunnel for research and for the economy. The German Research Institute for Aeronautics and Astronautics (DFVLR) in Cologne-Porz is participating in the ETW along with the respective institutes in France, the United Kingdom, and the Netherlands.

The Federal Ministry for Research and Technology (BMFT) participation share amounts to 24.2 percent, that is DM136 million between 1988 and 1994. In addition, North Rhine Westfalia is participating with 10 percent and the aviation industry with 3.8 percent. This represents a further important contribution by the FRG government towards reinforcing and the economic and technological position of North Rhine Westfalia.

Wind tunnel experiments which can simulate realistic aerodynamic conditions on full-scale models are essential for improving aircraft design and to ensure the technical feasibility of development concepts. The ETW is the most economic wind tunnel concept for the simulation of in-flight conditions and transonic testing.

For the first time, higher speeds of large civilian aircraft can be simulated perfectly using models. The plant is run on coded nitrogen and is thus based on state-of-the-art technology.

The ETW, which will begin trial operation at the end of 1992, is the most highly developed testing facility for aircraft models in Europe and is expected to surpass the corresponding NASA facility. Thus the ETW will allow the European aviation industry including Airbus to make advances in the improvement of aerodynamics. This will increase the competitiveness of the European aviation industry.

With an investment capital amounting to DM562 million, the ETW is one of the largest high-tech projects presently being carried out in Europe.

The choice of Cologne as a location by the four partner countries means that there are now five European research organizations based in the FRG. In addition, the ETW is the first European research facility to be located in North Rhine Westfalia. As one of the largest building projects in the Cologne area, the ETW will make an important contribution towards reinforcing the local economy not only during construction but also during operation.

08706

BIOTECHNOLOGY

EC's Biotechnology Action Program at Advanced Stage of Definition

3698m310 Brescia BIOTEC in Italian No 2, Mar-Apr 88 pp 59-60

[Text] The BAP [Biotechnology Action Program] still requires two years to completion but the EC Administration for Research and Development (Agency XII) already has numerous initiatives ready for the financing of biotechnology promotion in Europe over the next few years.

The Biotechnology Division is already thinking about future developments in the wake of the BAP, which from 1990 to 1994 should materialize in the implementation of the BRIDGE program [Biotechnological Research for Industrial Development and Growth in Europe] mentioned above.

BRIDGE is currently being formulated in detail; the commission has already defined a framework program which would cover four major areas:

1—data processing infrastructures and biological material collection;
2—technology development;
3—multidisciplinary applications in industry and agriculture;
4—risk evaluation and identification of appropriate standards.

On the basis of this work and of the suggestions made by the various national delegates, the Biotechnology CGC decided during the meeting of 2 December 1987 to organize a number of working groups composed of both CGC members and external experts. These groups will be responsible for identifying objectives of real economic-industrial interest at a community level within each of the nine major areas of activity.

Nine "brainstorming teams" were therefore organized for the following nine areas:

1—risk assessment;
2—bioreactors;
3—protein engineering;
4—bioinformatics;
5—microorganisms for industrial use;
6—cultivable plants and related microorganisms;
7—animal production and health;
8—biotransformation processes;
9—pharmacology and toxicology in vitro.

In January and February these working groups issued a series of reports providing the basis for discussion and in-depth study on the future development of the feasibility project and of the call for bids scheduled for the presentation of the "proposals."

During the last CGC-Biotechnology meeting (16-17 February), these reports were officially submitted to the commission.

Only the next CGC meeting will tell us whether the BRIDGE structure has been further defined.

08606

EUREKA Commissions Biotech-Microgravity Project

3698A305 Paris LA LETTRE HEBDOMADAIRE DU GIFAS in English 7 Jul 88 p 2

[Article: "Matra and the European 'EUREKA' Program"]

[Text] Under the EUREKA project, CNES [National Center for Aerospace Studies], Matra and Roussel Uclaf have been commissioned with developing the European "Purification in Microgravity" project. This initial biotechnological contract in the microgravity field has been placed in a European context with six manufacturers in France, Belgium, and Spain. The project will last six years and involve Fr 185 million. Under its terms, manufacturers will develop a laboratory for purification of biological space products: Space Bio Separation (SBS), in collaboration with the scientists concerned, notably those of CNRS [National Scientific Research Center] and the Paul Sabatier University of Toulouse. The program consists in developing a complete fully automatic purification cycle operating in microgravity environment.

FRG Progress in Gamma-Interferon Crystallization

3698m438 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 479, 13 May 88 pp 13-14

[Text] Proteins, such as hormones, interleukins or interferons, do not always possess the required properties. Sometimes their stability or activity requires improvement. To alter them efficiently the molecular structure of the proteins must first be determined and analyzed in terms of the desired function. However, to do this, crystals suitable for X-ray structural analysis must be grown from the protein. This is very difficult and one of the reasons why the structure of many genetically engineered substances is still unknown.

This problem has been overcome in the case of recombinant gamma interferon. A cooperative group consisting of researchers from the Society for Biotechnological Research (GBF) in Braunschweig and the Fraunhofer Institute for Toxicology and Aerosol Research in Hannover has recently succeeded in generating crystals suitable for X-ray structural analysis. This is the first major step in structure determination. It is now possible to tailor alterations in gamma interferon, for example, to increase stability against proteases or to design antagonists.

For companies involved in the development and production of gamma interferon, this breakthrough will mean a decisive increase in its design and application possibilities. Due to its action against viruses, its inhibition of cell growth, and its effect on the immune system, gamma interferon is important in the treatment of various types of cancer and polyarthritis. Selective alteration of the molecule could improve these characteristics.

The molecular structure research group (under the direction of Dr D. Schomburg and Dr Hans-Juergen Hecht) at the GBF and the genetic engineering department (under the leadership of Dr Bernd Otto, Miss Schoen and Mr Slodowski) at the Fraunhofer Institute for Aerosol Research and Toxicology are cooperating in research on structure determination and subsequent selective alteration of gamma interferon. The former are working on structure research and modelling and the latter are involved in genetic engineering and protein chemistry.

08706

Netherlands Launches Biosensor Program

3698A243 Paris BIOFUTUR in French Apr 88 p 13

[Article by Dr D. J. Sprangers: "Netherlands Focuses on Biosensors"]

[Text] A national research program on biosensors is being launched by the Netherlands Ministry of Economic Affairs at a cost of 5 million guilders (Fr 15 million). The program will be coordinated by Twente Technology Transfer and involve several universities. The Netherlands will also benefit from another large-scale biosensor project directed by the Netherlands Organization for Applied Scientific Research (TNO). Costing 2 million guilders (Fr 6 million) per year, the project is partly financed by industry. It focuses on the development of biosensors for measuring oxygen concentrations in liquids.

25048

COMPUTERS

Major European Software Company Established

3698A211 Amsterdam COMPUTABLE in Dutch 8 Apr 88 pp 3, 12

[Article by Robbert Hoeffnagel: "CAP and Sema-Metra Merge into SEMACAP: French/British Tandem Becomes Europe's Number Two"; first paragraph is COMPUTABLE introduction]

[Excerpt] Amsterdam—The CAP Group, the UK software and systems company, is merging with its French counterpart, Sema-Metra. The new company will be the

second largest computer services company in Europe after CAP Gemini Sogeti. The merger will have direct consequences for CPP Nederland, a CAP subsidiary, and for Volmac, which has acquired a little less than 10 percent in the CAP Group since 1986.

Although the new company names several reasons for the merger, the major motive was the two companies' desire to prepare for the market of the 1990's. The SEMACAP partners estimate that the European domestic market will be $76 billion in 1992 and $150 billion in 1996. Expansion is necessary if one is to accommodate such a vast market.

The merger should lead to this coveted expansion, just as System Designers is hoping to expand by taking over Scicon. SEMACAP will employ 6,400 people and, according to estimates based on results of earlier fiscal years, the group's revenues will exceed 850 million guilders with a little over 55 million guilders in profits. The company headquarters will be established in London, mainly for fiscal reasons. Top management will consist of two persons: Mike Smith of CAP and Pierre Bonelli of Sema-Metra. CAP's present chairman of the board, Barney Gibbens, will become chairman of the new board of directors.

Combination

The merger is accomplished through the exchange of shares. Until 22 April, 24 CAP shares can be exchanged for one Sema-Metra share. Thus, present Sema-Metra shareholders will get a 54.6 percent stake in SEMACAP and current CAP stockholders 45.4 percent. The difference is an indicator of the volume of each company: Sema-Metra with 144 million pounds in revenues (over 500 million guilders) by far outstrips CAP's 100 million pounds (350 million guilders) turnover.

Both companies complement each other in activities as well as geographical distribution. CAP is active in Great Britain, the Netherlands, Singapore, and the United States, whereas Sema-Metra, in addition to France, has subsidiaries in Spain, Belgium, West Germany, and Africa. Both companies also offer a wide range of services in the areas of commercial and technical/scientific systems, consulting, and military applications.

25072

DEFENSE INDUSTRIES

French Laser Missile Tested

3698A306 Paris LA LETTRE HEBDOMADAIRE DU GIFAS in English 21 Jul 88 p 2

[Report: "Taking Stock of the Tests on the 'AS 30 Laser' Missile"]

[Text] The firing of an AS 30 Laser missile by Aerospatiale, marking the end of the technical-operational evaluation, took place on June 21 at the Landes test center (CEL). Firing was from a Jaguar carrying an "Atlis" [as published] pod. The missile, fired at a range of more than 10 km, an altitude of 70 m, and at a velocity of 585 kts (1085 km/hr) confirmed its operational capabilities: flexible use with a wide range of speeds and firing altitudes (from very low altitude to 6000 m); excellent probability of target destruction on the first pass, reinforced even more by the possibility of salvo firing; firing at a safety distance independent of altitude, making it possible to avoid the short range surface-to-air defense of the target. It should be underscored that the AS 30 Laser is an air-to-ground missile, intended for the attack of hardened independent targets. This supersonic weapon carries a very powerful payload (150 kg). Guidance is on a laser spot, endowing it with excellent accuracy. The missille is in service in the French Air Force on the Jaguar, and also operational on the Mirage F1 and Mirage 2000, and can be adapted to any assault fighter (F16 or Tornado, for instance).

LASERS, SENSORS, OPTICS

Thomson-CSF, LCTAR To Develop Radar for Stationary Objects

3698A308 Paris LA LETTRE HEBDOMADAIRE DU GIFAS in English 14 Jul 88 p 2

[Report entitled "Thomson-CSF: LCTAR Chosen by SEFT/DAT for Development of a Radar Prototype"]

[Text] LCTAR's proposal has been selected after a consultation concerning the studies and building of an exploratory radar prototype capable of detecting unmoving objects. The consultation was issued by "Section d'Etudes et de Fabrication des Telecommunications" (SEFT/DAT—Direction des Armements Terrestres de la Delegation Generale pour l'Armement). Stationary targets cannot be detected using the usual Doppler methods. Consequently, LCTAR has proposed employing a number of new methods on the basis of studies conducted by DRET ("Direction des Recherches et Etudes Techniques de la DGA"), which have to some extent already been experimented with. The commercial proposal submitted by LCTAR covers the overall industrial phase of the program, from initial exploratory development to production, planned for the early 2000s. To ensure optimum cost and deadlines, LCTAR will base its work on the industrial facilities of the Thomson Group, especially, the Group's production centers specialized in radar matters.

Italian Role in Super-Laser Development Reviewed

3698m443 Milan ITALIA OGGI in Italian 13 Jun 88 p 19

[Article by Michele Fontana: "Italy Is in Key Position in the Race for the Super-Laser]

[Text] Milan—An important result in the study of increasingly small particles of matter was reached recently at the Milan Polytechnic by the team of

researchers headed by Orazio Svelto (Sandro de Silvestri, Vittorio Magni, and Paolo Laporta). This was the production of a 50-femtosecond (equal to 50 millionths of one billionth of a second) pulse of laser light. This achievement places the Milan Polytechnic on an equal footing with some of the most advanced laboratories in the world, such as the AT&T Bell laboratories at Holmdal in the United States, where the "femtosecond" laser was produced for the first time by the team of researchers headed by Charles Shank.

"The 50-femtosecond pulse of laser light is the event with the shortest duration ever achieved by man," states Orazio Svelto. The Bell laboratories have announced that they have even reached a 6-femtosecond pulse but, as Svelto explains, the output pulse obtained by the Americans is the same as that obtained by the Italian research team. The pulse obtained by the Americans was subsequently made even shorter by further processing of the signal.

Pulses as short as these have important uses in a number of application and research areas. In the physics of matter it is possible to "observe" the behavior of electrical charges inside semiconductors and, in particular, inside the new class of semiconductor composites—the so-called "quantum hole" composites—on which leading edge research is focusing. In the Bell laboratories a new technique for observing ultra-high integration circuits was recently developed by Janis Valdmanis using the new laser. "The instrument developed by Valdmanis for the first time makes it possible to use instruments to observe optical circuits with a resolution of a few microns," explains Federico Capasso of the Bell laboratories at Murray hill, "and the exceptional importance of this technique is that it allows one to measure the variation of voltage with time at all points in the circuit without disturbing the medium under observation."

One of the most promising areas of application is that of fiber optic communications. "To achieve extremely high channel capacities," comments Svelto, "the light pulses sent along the fiber have to be as short as possible." With a pulse of 1 nanosecond (one-billionth of a second), the quantity of information that can be sent is equal to 1 Gigabit per second. With pulses of 1 picosecond (one-thousandth of one-billionth of a second) it is possible to reach 1,000 Gigabits, and so on. Recently, again in the Bell laboratories at Holmdal, Linn Mollenauer sent a 100-femtosecond pulse along 4,000 km of optical fiber, with the pulse being regenerated optically at 40-km intervals. "In future it will be possible to send 10,000 Gigabit per second," concludes Svelto.

In the chemical sector the applications of the femtosecond laser make it possible to observe certain stages of chemical reactions which it has never been possible to study before. For example, it is possible to watch [the process of both] the formation and the disintegration of molecules. Experiments of this kind have been conducted by Ahmed Zewall of the California Institute of Technology.

According to Svelto, one field in which the new laser may lead to interesting discoveries is that of biophysics. It will be possible to study what are referred to as "primary photophysical events," which occur extremely rapidly. "In nature, the two most important classes of molecules which interact with light," explains Svelto, "are, first, the molecules which permit chlorophyl synthesis or, in other words, the transformation of light energy into chemical energy and, second, the rhodopsin molecules located inside the rods of the retina, which transform light signals into electrical impulses. In both cases the processes which occur in the initial stages of the transformation of the light energy—processes which are extremely rapid and incredibly efficient—are not yet fully understood."

It may also be possible to apply the rapid-pulse laser in the sector of inertial fusion, where the nuclear reactions necessary for the release of energy take place, thanks to the use of a high-power laser beam which strikes small pellets of fuel. The study of ultra-rapid phenomena is becoming one of the leading topics for research in the physics of matter in the world.

The Light Beam Business

Application	1985	1986	Percentage Change 85/86	1987	Percentage Change 86/87
Treatment of materials	95,031	112,520	18.4	131,300	16.7
Agriculture/construction	2,087	2,110	1.1	2,205	4.5
Control and measurement	13,477	14,560	8.04	15,565	6.9
R&D	104,125	116,740	12.12	129,510	10.94
Reading of bar codes	10,378	12,000	15.63	14,000	16.67
Regrographics	30,361	32,250	8.22	31,300	-2.95
Engravings for printing	857	1,005	17.27	1,100	9.45
Color separation	11,696	11,210	-4.16	11,620	3.56
Optical memories	24,539	35,780	45.81	48,285	34.95
Optical communications	83,250	86,360	6.14	76,740	-13.15
Medical diagnostics	7,031	8,860	26.01	11,855	33.80

The Light Beam Business

Application	1985	1986	Percentage Change 85/86	1987	Percentage Change 86/87
Medical treatments	61,931	70,460	13.77	82,335	16.85
Entertainment and leisure	2,396	3,056	27.55	3,540	15.84
Total	447,159	508,911	13.81	559,355	9.90

Note: Data for the world market, in millions of dollars.

08616

MICROELECTRONICS

Belgium's Mietec Viewing International ASIC Market

3698A216 Kalmthout INDUSTRIE MAGAZINE in Dutch Apr 88 pp 36-41

[Article by Wim Heirbaut: "Mietec Working on Its International Breakthrough"]

[Excerpt] What was initially considered a Flemish prestige project is now developing into an ASIC manufacturing unit with worldwide ambitions. Mietec now belongs to the French Alcatel group. Its 1.5-micron CMOS technology—intended mainly for ISDN products—should finally allow the Oudenaarde-based plant to run at full capacity.

1.5-Micron CMOS Is Mietec's Driving Force

In the past, Mietec had major problems "filling the plant," i.e., getting orders to match its production capacity. This was partly because Mietec had not yet made a name for itself—even though it occupied a leading position in the integration of analog and digital circuits on a single silicon wafer—and also due to Mietec's 2.4-micron CMOS technology. This has changed recently. Following a recent agreement with Thomson-SGS, Mietec acquired 1.5-micron CMOS cell libraries. Moreover, the idea is to acquire 1.2-micron technology within 2 to 3 years. The agreement with Thomson-SGS is now being implemented: The Oudenaarde production infrastructure is being upgraded to the tune of 2 billion Belgian francs.

A similar agreement with the U. S. VLSI-Technology plant had previously been considered. Says Alain Gilot: "There were indeed meetings with VLSI-Technology in 1987 during our search for a submicron technology. However, they were unfruitful. We have continued our contacts with other companies in the meantime."

To date Mietec has consistently incurred losses. The 900-million-Belgian-franc turnover in 1987 represented a 30-percent increase in revenue compared to 1986. However, further improvements are needed. Management is hoping for another 30-percent increase in turnover. In 1988, Mietec should realize a profit for the very first time.

How is Ron Spooner planning to do this? Of course, there is the telecommunications sector, which mainly provides contracts for the Alcatel group. The principal aim in acquiring 1.5-micron CMOS technology is to develop the ISDN program. Mietec is the prime supplier but is not excluded from the competition game. "Like any other organization, we must be competitive, even within the group," says Ron Spooner.

Two Growth Markets

Furthermore, Mietec is going to play a major role in establishing a pan-European mobile telephone network. Through Alcatel, Mietec is also a member of the ECR900 group, a club formed by three companies: Alcatel, Nokia of Finland, and AEG of West Germany. This club is planning to spend $180 million on hardware and software development over the next 4 years. Alcatel, Nokia, and AEG will, respectively, bear 50 percent, 35 percent, and 15 percent of the costs. About 400 engineers are involved in the project. The collaboration is slated to last 6 years and the products will be compatible with three types of exchanges: Alcatel's E10 and System 12, and Nokia's DX200.

"We are currently defining the circuits," says Ron Spooner. However, Mietec will not necessarily be the prime supplier. Comments Ron Spooner: "In telecommunications, one feels more secure if there are also second-source suppliers."

Mietec's activities are not restricted to accepting orders from Alcatel. One of Spooner's major tasks is to launch Mietec internationally as a custom IC supplier.

Spooner sees two growth markets for applications: the telecom sector and the automobile industry. As for telecommunications: "I felt there was an opening for a PABX line interface IC (editor's note: an IC that converts analog signals into digital signals in a private exchange). Exchanges with fewer than 150 lines still have discrete line interfaces because as yet it is still too expensive to use an IC for this purpose. Last August we decided to develop a standard and—what's more—reliable IC. In this market, reliability and price are key

elements. Our response is the MTC-6042, a product that I have had to push through, but that I expect will be very profitable for Mietec. The current market—new products as well as replacements—covers 12 to 15 million PABX lines, of which approximately 6 million are still discrete."

Another growth market is the automobile sector, where Bosch is Mietec's major customer. At the recent automobile exhibition in Brussels, the Mercedes stand displayed a set of six chips: four carried the Intel label and the other two were designed by Mietec.

Spooner is also gaining contracts outside the automobile sector. In early February, a French coffee-maker manufacturer placed an order for 200,000 chips per year.

Mietec also supplies 50,000 chips per year to a West German telecommunications and computer manufacturer. The company got into trouble when one of its employees quit, taking the design with him. The volume is not impressive, but it does represent a breakthrough with a firm with which we had not dealt before," says Spooner.

Main Assignment: International Breakthrough

One of Spooner's major goals is Mietec's international breakthrough. Branches in London, Paris, and Munich already exist, but Mietec has not yet penetrated a number of promising European markets. This is why Spooner recently went to Italy for 2 weeks, while his counterpart in Paris investigated Spain. The sales director for Belgium is now doing the same in Scandinavia (his department has been renamed "Benescan"). Mietec already has an agent in Italy: Celdis, a European distribution house with headquarters in the UK. Spooner is still looking for an agent in Scandinavia, but does not expect very much from the Spanish market: "Spain has fewer companies than Italy," according to Spooner.

Current management is confident about Mietec's future. Alcatel and Thomson-SGS provided the Belgian chip manufacturer with a European thrust which it did not get from Bell Telephone. In addition, Mietec has a lot to offer technologically. It occupies a leading position in mixed-mode IC's (analog and digital on a single chip), certainly in Europe. Mietec has also recently introduced a technology of its own: SBIMOS, a 3-micron process with a 40-V bipolar technology on a single substrate. SBIMOS combines CMOS low-power consumption with supply current control features inherent to bipolar structures. This makes this technology extremely useful for applications in cars and industry.

Moreover, in May Mietec will officially introduce Made II, a faster version of its own CAD system. The new Swan simulator makes Made 5 to 40 times faster. According to Spooner, "simulation can now be done on the same day as design."

25048

UK Firm Repairs Chips With Ion Beam

36980386 Duesseldorf VDI NACHRICHTEN in German 8 Jul 88 p 11

[Article by Leon Clifford: "Ion Beam Repairs Chips"]

[Text] Bonn, 8 Jul 88—Tiny little microsurgical repairs on faulty semiconductor chips is the future market for a small British high-tech company. As usual, it was all just coincidence here too, because when the company was founded no one was thinking of repairing chips.

Initially, the company built only ion radiation machinery—the company Oxford Applied Research (OAR), which had originated at Oxford University. And its thrust into the microchip market was actually by chance. A chip developed by engineers of the British electronics firm STC was giving them trouble, and it transpired that OAR with its ion radiation machine could offer the solution.

"The machine was a tool in search of a task, and then came STC with its problem which we were able to solve," says Dr Roy Clampitt, managing director of OAR. The operation required a precise incision on eight chip prototypes by means of the ion radiation machine in order to eliminate a short circuit. In this manner a 6-week delay in starting production of this chip could be prevented.

Clampitt regards chip repair as a business branch that is likely to grow. And for him the challenge now consists in breaking into this market, for which he envisions major opportunities.

Until recently it was not possible to fiddle with the structure of a silicon chip, because no tools were available which could be guided with the required precision. Today, chips are routinely manufactured with surface structures which are only 1 µm wide or even narrower. For this reason the "chip doctors'" electronic "scalpels" must be capable of undertaking incisions on this same order of magnitude.

Clampitt's ion radiation machine is useful in this area. It can make very small and precise cuts by directing onto the surface of the material an ion beam that is controlled and focused by electric fields with a precision of better than 1 µm.

Ion beams have a clear advantage over other cutting techniques such as laser and electron beam cutting. Cutting lasers produce a powerful and intense beam of energy. The cutting takes place through evaporation of layers of material, whereby hot erosion products could scatter over the remaining surface. Furthermore, the beam cannot be focused in a very precise manner and there is danger that reflected beams could cause unwanted damage.

Ions Bore Into the Semiconductor Layer

Electron beams use kinetic energy in order to eliminate the material, but since atoms have considerably more mass than electrons, electron beams are not very effective. They are more useful for microscopes.

Ions have approximately the same mass as atoms and can transfer considerably greater kinetic energy onto a surface. An ion beam bores into the material with the full force of collision. A very rapid ion literally shoots an atom out of a material, and with a powerful ion beam it is thus possible to remove material.

Clampitt and his OAR team began working on a "very bright ion source" in 1980. It was developed within the framework of a research program with British Science and Engineering Research Council. The costs were shared. "I directed the project specifically toward milling and etching, since from the standpoint of the company I saw a potential market for it," Clampitt reports. "Our machine is essentially an ion scanning microscope. A focused ion beam machine can do the same thing as an electron scanning microscope. It can locate a fault on a chip, and we can even use it to eliminate the fault."

The machine can have its function switched from a microscope to a cutting tool simply by accelerating the ion movement. This takes place through the reinforcement of the electric fields. Being able to use a machine for both observation and cutting is ideal for repairing chips.

In chip production an unwanted metal bridging, for example, can cause a short between two components on the chip and make it unusable. However, if this bridging is removed and the short eliminated, the electrical integrity of the chip is restored.

"In the case of a metal bridging that is accessible, it can be cut apart," the OAR chief notes, "and yet most manufacturers of fully customer-specific chips have never heard of this method."

STC's problem, for instance, consisted of an unintentional metal connection, which occurred on eight prototypes of a new telecommunications chip, which STL, a research branch of the STC, had developed on the basis of a 2-µm double layer CMOS-VLSI technology. "The big STC with all its microscopes was able to see the fault," Clampitt says, "but could not do anything about it."

David Wright, project leader at STL, indicates that the chip prototypes were manufactured by a semiconductor company in the United States. "The design was correct, but in the final phase of the physical layout an error occurred in the United States."

"The chip contains 70,000 components and 100,000 connections, one of which has been put on top of another instead of going around it," Wright explained. "We knew that these eight chips were functional except for the short. The most immediate solution was to eliminate this through an incision."

The cut had to be 20 µm long, 2 µm wide and less than 1 µm deep. The available laser achieved a point 10 µm in diameter, however, which is much too large when the chip has structures that are only 2 µm or 3 µm apart from each other. An electron beam would have separated the material, to be sure, but the 1 keV energy needed for that would have destroyed the rest of the chip. The only possibility was OAR's ion beam.

Clampitt has recognized a double market for OAR. "We are going to establish a chip repair shop in Breat Britain for small companies and in addition sell machinery to major chip manufacturers, which have their own diagnostic facilities in their laboratories. We have developed a fabulous machine, which is now going into production."

11949

SCIENCE & TECHNOLOGY POLICY

EC Research Ministers Give Final Approval for ESPRIT Phase Two

3698m317 Milan ITALIA OGGI in Italian
12 Apr 88 p 19

[Article by Elyza Fazzino: "Europe Relaunches the Technological Challenge"]

[Text] Brussels—Europe is preparing to give the United States and Japan some competition in advanced technology, trying to make up for the opportunities lost last year when the infighting over funding among the 12 EC countries threatened the continuity of the community's research and development programs.

The research ministers of the European Community, meeting yesterday in Luxembourg, made a whole series of basic decisions for European industry. The most important decision was the final approval of Phase 2 of ESPRIT, the European program for information technologies, the leading edge of EC research programs, which will cost some 4.7 billion ECU's (about 7 trillion lire) between 1984 and 1993. The group of 12 reached agreement on a number of less important programs. However, there was no agreement on controlled thermonuclear fusion, while the future of the joint research center (CCR) and the restructuring of the Ispra laboratory are still to be decided. The Italian research minister, Antonio Ruberti, emphasized the urgent need for a decision, essential for a relaunch of the CCR.

For Ispra, the plan is for a gradual increase in staff mobility and greater financial diversification, with the definition of contracts with one or more EC countries and with industrial partners. The 12 countries may reach a decision at the next meeting of the research council, to be held on 29 June.

ESPRIT 2: The go-ahead given yesterday was only a formality. Companies have already submitted to Brussels an initial series of projects, from which the European Commission will select the ones that are to receive community funding. The projects will be implemented in the form of contracts between the European Commission and the companies, universities, and other organizations selected.

The deadline for applications was today. All the major European computer companies are in the running; the FRG company Siemens, the French company Bull, and the British company ICL have formed a consortium to present a joint program for the design of the next generation of computers at a cost of 85 million ECU's (approximately 130 billion lire). This initiative is in competition against the consortium formed by the Italian company Olivetti and the Netherlands firm Philips. The commission will make its decision by the end of May, and it is possible that it may try to encourage the rival candidates to combine [their efforts]. The first projects may well be launched this summer. Phase 2 of ESPRIT is scheduled to receive community funding totaling 1.6 billion ECU's (approximately 2.5 trillion lire), a figure that will cover 50 percent of the total costs. The program will involve more than 500 researchers and will focus on three sectors: microelectronics, data processing systems, and information technology applications.

DRIVE: The ministers agreed on a program to apply data processing to road traffic. The objectives include the "intelligent automobile," a system that seeks to improve highway safety, reduce traffic congestion, and lower environmental pollution. For this program the EC plans to spend 60 million ECU's (almost 100 billion lire) over a period of 3 years. Following the vote of the European parliament, the program is expected to begin in July with the publication of the conditions for participation in the program. The first projects may be launched in early 1989.

DELTA: This is a program for remote training, which seeks to apply new technologies to learning. Here also, the 12 countries are in agreement. The EC is scheduled to spend 20 million ECU's (30 billion lire) over a period of one and a half years.

Science: There is preliminary agreement for a program to encourage researcher mobility. Funding of 167 million ECU's (260 billion lire) has been allocated.

Biotechnology: An agreement to increase by 20 million ECU's the financing for a program to develop biotechnologies to improve agricultural and bio-industrial products has been reached. But the current chairman, Heinz Riesenhuber of the FRG, also included a discussion on the ethical aspects of biotechnologies, with reference to the congress on biotics currently in progress in Rome.

Applied Metrology and Chemical Analysis: This seeks to align the standards for technical measurements. Funding is expected to total 59.2 million ECU's, approximately 90 billion lire.

Research and Development in the EC (in millions of ECU's) 1987-1991 Program

Information technology	2,465
Technological innovation	989
Energy	1,752
Biological resources	310
Quality of life	479
Research in developing countries	80
Ocean resources	80
Cooperative research programs	325
Total	6,480

Funding for ESPRIT 2

Research and development including:	1,490
Microelectronics	475
Data processing	475
Information technology	548
Management expenses including:	110
Personnel	64
Administration	38
Total	1,600

08615

EC Commission Calls For Further Cooperation With EUREKA

3698A302 Brussels EC PRESS RELEASE in English No IP(88) 385, 23 Jun 88 p 1

[Report entitled "The Community Intends To Strengthen Its Cooperation With EUREKA"]

[Text] In a communication it adopted recently, the Commission recommended strengthening cooperation between EUREKA and the Community on secure foundations of complementarity.

Ever since the EUREKA initiative was launched in 1985, the Commission has regarded EUREKA projects as complementary to its own research and technological development activities, since they normally focus on objectives that are closer to the market-place than Community R&D programmes.

The Commission is already directly involved in a number of major EUREKA projects, but the time is now ripe to go further, since the environment has changed: EUREKA projects often cover fields in which the Community is already playing an important role; the Community has adopted the Framework Programme (1987-91), the aim of which is to encourage cooperation in pre-competitive or basic research; Europe clearly needs to make rapid progress in sectors of crucial importance for the future, such as microelectronics, aeronautics, superconductivity, biotechnology and the environment; and the EFTA countries, which are taking part in EUREKA alongside the Member States, are now more closely associated with the Community's R&D efforts as a result of bilateral agreements giving them access of various kinds to Community programmes.

The Commission proposes that the Community take action in five areas in order to make a greater contribution to the success of EUREKA:

- establishing a sound basis of complementarity between EUREKA and Community programmes in order to ensure continuity;
- helping to finance pre-competitive EUREKA projects: direct participation by the Joint Research Centre in consortia presenting EUREKA projects is envisaged; funding, on a cost-sharing basis, is available for pre-competitive projects through the normal transparent selection procedures applying to the Community programmes concerned. The Commission stresses, however, that the available funds are limited, and the real solution would therefore be to increase the budget set aside for Community programmes. In line with the decision of the European Council of 11-12 February 1988, the Commission will request the Member States to provide the Community with increased resources when the Framework Programme is revised;
- using the possibilities offered by Article 130L and 130M of the Single Act, which provide for the creation of supplementary programmes and types of participation as a means of extending the range of possible methods of Community involvement and ensuring the necessary flexibility according to the activities envisaged;
- mobilizing private finance, in particular through promoting the Eurotech Capital Investment Fund and provision by the Community of risk insurance for advanced technology projects;
- improving the economic and business environment by completing the internal market, which will, among other things, prevent the creation of new technical barriers to trade and open up public procurement in Member States. In this context, the Commission will continue to work closely with the EFTA countries.

EC Council Funds Information Services Program

3698A303 Brussels EC PRESS RELEASE in English No IP(88) 480, 27 Jul 88 pp 1-2

[Report: "New Community Programme To Develop European Information Market"]

[Text] Professional electronic information services will be a decisive factor in achieving the Community's 1992 objective of a unified internal market. An action plan for a European information services market has therefore been given the go-ahead by the Council of Ministers, who agreed to allocate ECU 36 million to a development programme covering an initial period of two years.

The Community funds will be used to co-finance pilot demonstration projects to develop advanced information systems in collaboration with companies across Europe. A call for expressions of interest issued by the Commission last year has already brought in more than 700 responses. The funds awarded by the Council decision will now allow the first projects to be launched in early 1989.

Introducing the programme, Commission Vice President Karl-Heinz Narjes said that the emergence of a "European information market" would contribute to speeding the integration and growth of the European economies. This programme will create new vehicles for locating and using information in the workplace, to draw on the vast amounts of public information which are still inadequately exploited. It will benefit those who use—or can potentially use—computer-based information for their work: from managers to engineers and workers to the shopfloor.

The Commission has received project ideas from both private and public sector organisations in all member States. First priority areas concerned are: Image banks, standards information, road transport information, tourism information and intelligent interfaces to electronic information services.

Action under the information services programme also includes setting up a European Information Market Observatory, which regularly tracks trends in the information market, improving the quality of market data and providing better decision-making tools.

Other areas highlighted for special attention by the programme include better exploitation of publicly-held information by the private sector, overcoming legal, administrative and technical barriers, simplifying information access methods, and support for users of information services.

EUREKA Projects, Organization Criticized

Project Quality, Coordination Questioned

36980369 Rijswijk PT/AKTUEEL in Dutch
22 Jun 88 p 11

[Article by Eduard Voorn: "Politics Entering Into EUREKA Program More and More"; first paragraph is introduction]

[Text] EUREKA is falling under the spell of politics. The originally pragmatic technology program involving 19 countries is not escaping the lobbying influences of politicians. For example, part of the success of this technology program depends on standardization, and the national authorities must come to an agreement with each other in this regard. Parliaments are also taking a look at whether a project exceeds the limit of hundreds of thousands. This week, the standing Chamber Commission for Economic Affairs is meeting to hear how Minister De Korte thinks the EUREKA JESSI project (submicron technology) should be set up. Government support for this multiyear program involving Philips will exceed the bounds of the Megaproject.

European technology policy is being pursued amidst turbulent stirrings. The focal point of the network that is emerging from EC programs and EUREKA is the bar. There are indeed often ideas for projects among researchers and the business community, but it is finding the necessary (foreign) partners that is a problem. For midsize and small companies in particular, there are barriers to obtaining a spot in that network. Even though it falls within the framework of EUREKA, the national governments perceive it, and central points are being set up by them where information can be found about international technology programs. "Our new EUREKA program WEES (modular expert systems in the area of welding) came into being in the international circuit," says A. Lourenssen, CAD/CAM manager at TNO-IBBC, matter-of-factly. "We have had ties for some time with the British Welding Institute. Our previous EUREKA program with the English was a rejected British proposal. A network has emerged in this sector of people who know each other, and at the bar during international meetings, the proposals start flying."

Status

The reason for getting involved, both for the institution and for the business community, is money and status. The Dutch government has a EUREKA budget of 50 million guilders, as joint financing for the feasibility and R&D studies. For institutions such as TNO, there is a problem with getting the total financing. "With EUREKA status and the guarantee of the government, we are now looking for sponsors in the Netherlands," says Lourenssen. "Besides financial input, we are also looking for companies that want to contribute in material terms. In that way, you are ensured of a number of test plants. For our part of the project to succeed, we need 15 to 20 companies."

The problem of private financing was also not resolved last week during the EUREKA conference in Copenhagen. The TNO approach is a good solution, but for small and midsize companies submitting proposals in particular, this constitutes a stumbling block. "Things are not going very fast in financing," echoes Minister De Korte. "We are continually engaged in trotting out new resources." In the meantime, the idea by the West German Bundesbank to pool private resources in order to finance EUREKA projects has been shelved entirely. According to a recent EUREKA study, the part that can be covered by private financing has grown to more than 60 percent. For the time being, there is no comprehensive solution.

Rolling

The EUREKA project is rolling on, despite the bumps in the road. At the conference last week, 54 proposals got the EUREKA stamp of approval. Since June 1985, the package has grown to 214 projects. In the beginning, this originally French initiative had rather weak funding. This situation changed because of the dedication exhibited by the offices in the participating countries. In Brussels, the umbrella office is working on promoting the data base and coordination between the countries, among other things. The consolidation phase has begun.

But what is the future of EUREKA? The quality of the projects that merit EUREKA status will determine the future of this initiative. The goal is to allow Europe to fight on the front lines of the international technology war. "Europe has abandoned its 'decline of the West' attitude and decided to be," were the prophetic words of Danish Prime Minister Schluter at the opening of the EUREKA ministers conference. Making it in the top echelons is only possible with quality and serious participants.

In the meantime, critical noises have been heard about the level of the projects. "There is chaff amidst the corn," says Lourenssen of TNO. "I think that at the end of the ride some projects will yield very meager results."

The failure of projects and thus possibly the loss of a battle with the Japanese and Americans can also be caused by the absence of unity. Europe is noted for a great deal of diversity in standards. In view of 1992 and EUREKA, it is utterly necessary that work on all possible standards be accelerated. The European standardization office CEN/CENELEC can play an important coordinating role in this.

Lobby

Politics is entering into EUREKA more and more. However regrettable this may be for the pragmatists, in the future it will certainly not be possible to circumvent the (odious) phenomenon of political influence. A nice little political lobby has developed around the billion-guilder JESSI project (new generation of submicron technology). According to the original list, this was to be a cooperative venture between Philips, Siemens and a French consortium under the leadership of Thomson. Discussion has arisen concerning involving the French-Italian joint venture Thomson/SGS. Philips and Siemens, the former Megaproject partners—JESSI can be seen as a sort of continuation—have adopted an extremely reserved position. The Megaproject brought Philips and Siemens back into the IC race. There is no desire to simply make the knowledge thus acquired available to the other party in JESSI.

The result of this attitude is that the matter was raised last week in Copenhagen. "I discussed the problems concerning JESSI separately with my Dutch and German colleagues," says French Minister of Research Hubert Curien. "The three companies now have to resolve the issues themselves. I expect that there will be greater clarity around September." The French are emphatically demanding that the companies must first line up their business before approaching the political side. Curien was unwilling to speculate on potential measures within EUREKA if the companies are unable to work this out.

The Netherlands

In the Netherlands, JESSI is the subject of deliberation before members of the standing Chamber Commission for Economic Affairs. One day before the EUREKA conference, there was a "secret" meeting between the members and Minister De Korte. Both De Korte and Chairman Pronk of the standing Chamber Commission were unwilling to comment on the background of these talks. "We have now had two closed meetings, and we felt that the minister should come out," says the PVDA member of parliament. The letter sent at the beginning of this week to the Second Chamber is the basis for this week's discussion and the starting point for a dialogue between the government and the Philips management. The Dutch government is not in the same position as the French one. Thomson is a state-owned company, while it is scarcely or not at all possible for the government to exert pressure in the Netherlands. An effort will have to be made via the channels of "reasonable consultation" in order for a project like JESSI to get a broad and sound foundation within EUREKA and in Europe. De Korte thinks that it is legitimate to get on a moving train at a later point and pay money for it. As one possible solution, he is thinking about defining certain sections as main areas and subprojects.

Better Coordination

The European Commission is also interested in good relations with EUREKA. The first steps towards better coordination between EC programs and EUREKA have been taken. The European Commission is working very hard on completing a second study on relations with EUREKA. In all probability, this document will be presented at the end of this month at the European Council in Hannover. "The gray area concerning the precompetitive domain (preliminary program) and the market (EUREKA) is looked at here," says Hendrik Tent, deputy director-general of Science, Research and Development for the Commission. "At the same time, we are convinced that more information must be forthcoming from the central EUREKA office and that the national project coordinators must be more selective."

In the meantime, the European Commission is a very important participant. Specifically, it was urged at the Copenhagen conference that standardization concerning the production of HDTV be tackled within the European Community.

These flanking government measures do not always by necessity involve technology. "The granting of permission by the national authorities to take our (data) communications equipment across the border and use it there would be a big step in the right direction," says R. Bleekrode, marketing manager of PTT Telecommunicatie. Together with DAF, SIMAC and the Danish company Thrane & Thrane, the state-owned company is developing and implementing an automated communications system (ROADACOM). A truck driver can communicate via satellite with his home base from the cab of his truck. Since there are two systems in Europe with their own standards—Standard C by Inmarsat and Prodat by ESA—this project is being developed so that it can function according to both standards. Bleekrode: "The umbrella organization of the European PTTs, CEPT, does evaluations and will ultimately choose one system."

More EC Involvement Urged

36980370 Duesseldorf HANDELSBLATT in German 1/2 Jul 88 p 2

[Article by Eberhard Wisdorff: "EC Research and EUREKA Lack Common Denominator: Need for Clarity Acknowledged"]

[Text] Indefatigably, Federal Minister for Research and Technology Heinz Riesenhuber toasts new projects at every conference of the European research initiative EUREKA.

However, the most recent debate in the EC Council of Ministers, the relevant memorandum from the Brussels Commission, the reactions of the European Parliament or even Riesenhuber's own memos all confirm that the EUREKA research project, which came into being in

1985 on the initiative of the French as a reaction to the American SDI plans for an antimissile system in space, is in trouble, and that in particular its relationship to research within the context of the Twelve is unclarified and problematic.

Both sides are talking about complementing each other and the need for clarity. The facts indicate that overlap, poor organization and mistakes in particular are in evidence. EUREKA was originally intended to promote products close to the market upon initiative by private industry. However, according to information from the round table of banks, which is responsible for private financing, nearly 90 percent of the programs are in the precompetitive stage or are oriented towards transnational projects in the public interest, such as environmental protection. It is precisely for that reason that private financing for EUREKA is lacking.

Greater Participation by the Community Proposed

In contrast, EC projects like ESPRIT (information technologies) or BRITE (modern technologies in conventional sectors) are very close to the market. Many projects overlap or have emerged from EC initiatives.

In his memorandum, which prompted the latest EC debate, Riesenhuber in turn called for greater participation by the Community—more specifically, the Commission—in EUREKA. The authorities in Brussels, originally annoyed about EUREKA and apparently still divided among themselves, have long reacted with a fundamentally open attitude, while at the same time asserting a number of practical objections. For example, the EC research finances have been largely exhausted by concrete programs, not least of all because of Bonn's restrictive attitude. Community research must take place in the precompetitive domain or in the area of basic research, which at any rate was not the original goal of EUREKA.

Strict Compliance With Rules of Competition

The Commission must ensure strict compliance with EC rules concerning competition and financial assistance; they may not be circumvented by EUREKA. The EC must stick to its institutional processes, including the European Parliament. Furthermore, it is obligated to take into account the interests of the smaller partners as well, which is not the case with EUREKA. Finally, even Riesenhuber recognizes that the Community cannot be circumvented, due to its leading role in establishing common standards.

Furthermore, the EC has for some time now had its own structure for dealing with projects with involving third parties (COST). Its cost sharing with private partners has proven itself in practice. The longer EUREKA exists, the more obvious is the question of whether this initiative is at all worth it, and whether it would not have been better from the very outset to have avoided fragmenting the European research capacity, in organizational terms as well.

12271

EUREKA Program Adopts Europari Projects

3698A304 Paris LA LETTRE HEBDOMADAIRE DU GIFAS in English 7 Jul 88 p 1

[Report: "Aerospatiale Participating in Four New 'EUREKA' Projects"]

[Text] The government representatives responsible for the EUREKA program met in Copenhagen and have given the EUREKA label to four projects grouped together under **"Europari"**:

- Eifas, which concerns automated assembly,
- Ecras, which processes parts made of composites,
- Space, for the study and construction of electric harnesses, and
- Spider, which involves simple metal parts.

The Europari program jointly submitted by five European aeronautical partners (Aerospatiale, Aeritalia, British Aerospace, CASA and MBB) also includes the **Paradi** study, for management of automated flexible workshops. This project was awarded the EUREKA label in June 1986 and is currently at the phase II development stage. Taken together, the **Europari** projects **(Paradi, Eifas, Ecras, Space, Spider)** represent more than 100 million ECU (European monetary units) for development work. Each of the four new projects aims at the integration and automation of engineering activities, from pre-project assembly to product support phase, and including study, production, quality and testing, in accordance with the CIM concept (Computer Integrated Manufacture).

Italy's Andreotti on EUREKA Project, Bloc Participation

AU0600845 Rome ANSA in English 0820 GMT 6 Oct 88

[Text] (ANSA) Rome [No date as received]—The countries of Eastern Europe could become involved in the Eureka projects for scientific and technological cooperation among the nations of Western Europe, according to Italian Foreign Minister Giulio Andreotti.

In a piece written for the coming issue of the Italian newsweekly EUROPEO, the diplomatic chief said that, "while visiting Bulgaria—a nation where the farm sector of the economy has declined from eighty to seventeen percent—I myself toured a computer manufacturer with an adjoining research center worthy of respect."

He said in his weekly column that he had voiced "the opinion that the counrries of the East might open up to the EUREKA scientific cooperation initiatives, now limited to Western countries and the non-aligned countries."

Andreotti also noted that he had, "listened with interest to the speech delivered to the United Nations General Assembly by French President Francois Mitterrand.

"Not only (because) of his authority as a statesman but for the fact that the promotion of the EUREKA projects leads to hopes for the realization of his significant opening," said the minister.

Austrian Innovation, Technology Fund To Subsidize Research

3698m439 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 479, 13 May 88 p 15

[Excerpt] After 3 months of preparation, the new Austrian Innovation and Technology Fund [ITF] has presented to the press its subsidy program and the new forms required to submit applications. The amendment of the second Nationalization Act of 2 July 1987 has approved the sale of federal shares in the Austrian electricity supply board, thus providing the capital funding for the ITF. The minister for finance has invested 8 billion shillings and invested the interests to subsidize ITF projects. This means that an additional 500 million shillings will be available for R&D in Austria.

Microelectronics and information processing, biotechnology and genetic engineering, new materials and environmental technology will be the main ITF subsidy fields. Priority will be given to R&D of new products and processes with commercial applications. Beyond this conventional technology subsidy, special attention will be paid for the first time to providing basic subsidies for new high tech companies. Finally, the ITF will also subsidize national and international cooperative research projects and thus support Austrian industry's efforts towards a greater involvement in international research cooperation.

08706

Finland's Nokia Data Joins X/Open

36980371b Rijswijk PT/AKTUEEL in Dutch 8 Jun 88 p 2

[Text] Nokia Data has joined the X/Open Group. The international suppliers of automation systems that are united in this consortium are committed to introducing the Unix control system on the market according to one open standard. Membership in the X/Open Group gives Nokia Data the opportunity to contribute in the future.

The X/Open Group has existed since 1984, and is an independent consortium of international automation suppliers. Its members are AT&T, Bull, Digital Equipment Corporation, Hewlett-Packard, ICL, NCR Corporation, Nixdorf, Olivetti, Philips, Siemens, Sun Microsystems, Unisys, and now Nokia Data.

12271

FRG Institute Develops Thin-Film Method To Measure Wear, Corrosion

3698m435 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 479, 13 May 88 p 11

[Text] A process for the measurement of wear and corrosion developed by the Nuclear Research Center in Karlsruhe (KfK) is arousing increased international interest. The largest automobile manufacturer in the world, General Motors, will be applying it in future motor development. Large Japanese industrial corporations want to buy the whole technology. With the aid of the so-called thin film activation process, it is now possible to have exact and continuous measurements of wear and corrosion in machines or production plants at relevant points during the operation. The process works with unique precision. Abrasion depths as little as one-hundred thousandth of a millimeter can be detected. The detailed insight now possible into the dynamics of wear and corrosion processes and the substantial time saving compared with conventional methods will pave the way for the development of stabler components in mechanical engineering and materials processing.

The process developed by the Institute for Nuclear Physics at the KfK is simple in line of principle: the thin surface layer of the tribologically loaded component is activated by radiation with charged particles from a cyclotron. The level of radioactivity generated by nuclear conversion, the so-called activation, is so low that the irradiated parts can be handled without any special protective measures against radiation. A reduction in the intensity of the gamma radiation in the radioactive atomic cores which can be measured directly from the component during operation by means of a sensitive crystal detector, or the increase of radioactive atomic cores in the machine's oil system serve as a measure of the abrasion of the activated layer—thus wear and corrosion can be monitored directly. Converting this project into practice was not easy. Depending on the object to be tested, surfaces measuring from as little as a fraction of a square millimeter up to a number of square centimeters and consisting of various materials are to be irradiated in such a way that a constant activation density, that is a constant density of radioactive atomic cores, is generated over the whole expected attrition depth. For this purpose a computer-controlled radiation unit was developed which not only ensures exact dosage, but also allows economically feasible, fully automatic, serial irradiation of a large number of completely different machine parts. The KfK has a high power, state-of-the-art, compact cyclotron for radiation.

The process can already be used on almost all technical materials. Ferrous materials are irradiated, for example, with deuterons, the positively charged atomic cores of hydrogen at energies of up to 50-million electron volts (MEV). In this way homogenously activated layers of depths ranging from 20 micrometers to 1 millimeter can be achieved—sufficient for all wear and corrosion problems. Various iron isotopes are converted mainly to cobalt isotopes with the mass numbers 56 and 57 which serve as radioactive tracers. Gamma radiation from these isotopes is measured using highly sensitive sodium iodide detectors. Although these detectors are often applied in nuclear engineering, the ones used here are specially designed for industrial conditions. Abrasions of the activated layer to depths of as little as one hundred thousandth of a millimeter can be detected in practice. By selective registering of the various tracer isotopes, which can be distinguished by their different radiation energies, it is possible to monitor simultaneously the various componenets of a machine while it is in operation.

Development of the process is being subsidized under the KfK Technology Transfer Program. It is already being applied in the FRG not only for motor development by all the leading automobile manufacturers, but also in many other areas of mechanical engineering.

In Europe it is being used by large chemical firms in the development of reliable components for materials processing. The components to be tested—including large-scale components—are first irradiated at the KfK and then installed at the test site where they are monitored continuously during operation. The process can be used, for example, in attrition measurement for improving materials and forms for cylinder liners, camshafts, gearwheels, train wheels, brake discs, and printer needles. Monitoring of corrosion in pipe bends is important for process technology. For the first time it is possible to make exact statements on maintenance intervals, thus making an important contribution to system safety.

08706

BMFT Increases Research Subsidies for Technical Colleges

3698m434 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 479, 13 May 88 p 10

[Text]

Technical University Research

There has been a substantial increase in recent years in the subsidies provided via the Ministry for Research and Technology [BMFT] for research in technical universities. In 1987, the BMFT subsidized 2,110 research projects at FRG technical universities with a total of DM534 million. This represents an increase of 12 percent compared with DM476.9 million in 1986. Since 1983 the Federal Research Ministry has increased project subsidization by 73 percent. The following table gives an outline of fund distribution over the respective research fields for the last 6 years.

French Research Programs Overviewed

3698A246 Paris CPE BULLETIN in French Apr-May 88 pp 41-42

[Article by Marcel Bayen: "National Research Programs"]

[Text] By the end of 1987, France's General Directorate for Research and Technology had initiated 11 national programs in key sectors.[1] These programs, responding to Ministry of Research and Higher Education guidelines, are financed by the Research and Technology Fund [FRT]. They constitute one of the ministry's major resources in its support for the development of industrial research.

The goals of the national programs are:

- to encourage cooperation among industrialists (especially technology transfers from large groups to small- and medium-sized businesses), between government research entities and companies, and, as an exception, among government agencies;
- to resolve "technological riddles," i.e., difficult technical obstacles leading to considerable potential economic profit.

In 1988, the national research programs will receive Fr 400 million, representing 43 percent of the total FRT budget. As we know, the Research and Technology Fund will reach Fr 930 million in 1988, a 24-percent increase over the previous year. In addition to financing national research programs, the FRT is also developing research training programs for people from industry (the CIFRE [Industrial Agreement for Training Through Research] agreements are an example), financing a part of the EUREKA program, and supporting various regional projects.

Federal R&D Subsidization Area	1982	1983	1984	1985	1986	1987
B Specialized basic research (particularly large-scale research facilities)	65.147 586	69.507 626	78.461 341	79.697 363	83.510 401	92.041 280
C Marine research, technology; Polar research	8.971 28	10.526 27	20.134 36	13.505 46	34.525 47	28.626 75
D Space research and technology	14.640 116	18.155 129	18.923 150	19.709 156	24.740 166	29.341 169
E Energy research and technology	55.392 166	42.175 170	47.065 183	46.297 196	51.971 204	64.396 222
F Research on environment, climate, safety	26.264 178	29.126 243	36.877 292	49.150 328	52.366 378	57.646 404
G R&D in the field of health	24.577 168	23.865 165	24.957 161	35.566 191	53.611 207	57.574 230
H R&D in the ergonomics of the workplace	10.954 64	9.473 61	8.555 58	9.011 60	10.694 76	12.625 67
I Information technology (including production technology)	36.266 138	29.162 145	29.053 135	30.522 101	51.311 98	72.295 120
K Biotechnology	12.507 74	19.076 95	24.806 96	30.665 96	35.114 116	44.730 137
L Materials research, chemical process technology, physics	22.448 186	29.368 227	28.602 211	26.185 227	31.116 221	34.887 225
M Aviation research and development	1.027 6	692 7	4.485 10	8.136 14	11.353 15	7.695 16
N Research and technology for ground-based transport (including traffic safety)	8.233 30	3.657 30	3.754 32	2.665 24	1.781 16	1.004 12
O Geosciences and research to ensure supply of raw materials	9.771 51	11.341 72	11.961 63	14.717 58	14.823 55	12.955 61
P Urban and regional planning, building research	2.215 22	1.785 14	1.285 12	878 9	5.971 11	7.776 16
T Innovation and improved infrastructures	0 0	0 0	0 0	0 0	2.036 1	200 1
U Specialized information	6.828 25	7.291 23	5.670 20	8.410 31	8.417 44	5.004 44
V Humanities, economic and social sciences	3.831 6	2.500 1	2.909 7	2.946 9	3.412 10	5.078 11
W Other, miscellaneous activities	2 1	4 1	77 2	91 3	40 2	20 0
Funding between 1982 and 1987 Increase in funding over previous year (%) Number of projects	310.501 1.849	307.925 (-0,81 2.036	342.369 (11,21 1.807	378.196 (10,51 1.936	476.965 (26,11 2.070	535.976 (12,01 2.110
These figures also include subsidization of the Central Archive for Empirical Social Research at the University of Cologne and the costs of the Antarctic Symposium at the University of Kiel amounting to following totals (DM1000):	2.090	2.115	2.130	2.267	2.309	00

BMFT Research Subsidies: 31 Dec 1987

First figure in each column indicates funding for university projects in the FRG and Berlin 1982-1987; second figure indicates number of projects running 1982-1987. 08706

Allocations per Program in 1987 (in percentages)

NATIONAL PROGRAMS

1987: Proportion of FRT allocations and other funding resources as a percentage of total program funding (estimates)

	FRT	Other Funding
Biotechnology	34	66
Food	22	78
Medical research	56	44
Social sciences	52	48
Technology and manufacturing	46	54
Electronics/computers	48	52
Research in planning and transport	15	85
Natural resources	43	57
Advanced materials	27	73
Advanced chemistry	43	57
Research for development	26	74
Total	33%	67%

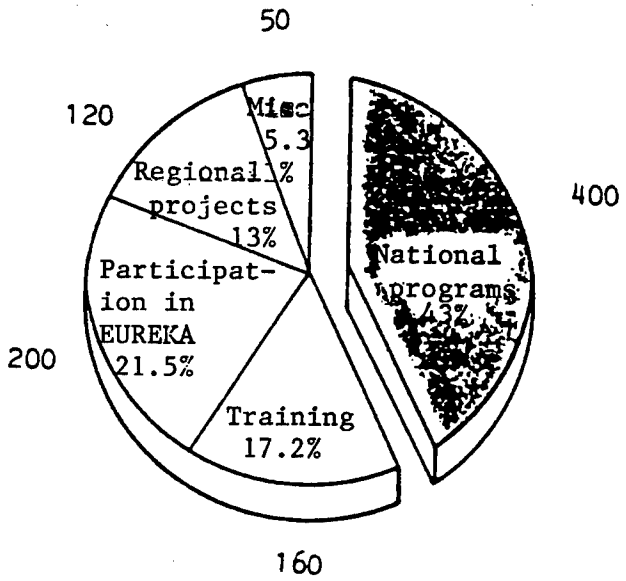

Figure 1. Allocations per Program in 1988 (in millions of francs)

Details of the 11 National Programs and 1988 Funding Levels (in millions of francs)

NATIONAL PROGRAMS	FUNDING (in millions of francs)	PRIORITY RESEARCH PROJECTS	SCIENTIFIC COMMITTEE PRESIDENTS	EXECUTIVE SECRETARIES
BIOTECHNOLOGY	21	-Microbiological engineering	Mr Douzou	Mr Aigle
		-Enzyme engineering	(Vice president:	Mr Thomas
		-Biotechnological engineering	Mr Boschetti)	Mr Thomas
FOOD	40		Program Committee: Mr Menoret	
		-Food sources	Mr Sabin	Mr Bassino
		-Agricultural products	Mr Feillet	Mr Molle
		-Nutrition	Mr Flanzy	Ms Bonnot

Details of the 11 National Programs and 1988 Funding Levels (in millions of francs)

NATIONAL PROGRAMS	FUNDING (in millions of francs)	PRIORITY RESEARCH PROJECTS	SCIENTIFIC COMMITTEE PRESIDENTS	EXECUTIVE SECRETARIES
MEDICAL RESEARCH	50	-Retrovirus: AIDS	-Mr Louisot	-Ms Bonnot
		-Aging and neurological handicaps	Mr Widlocher	Mr Fleury
		-Human genome	Mr Dausset	Mr Jeanteur
		-Medication, molecular pharmacology	Mr Sassard	Mr Fleury
		-Biological and medical engineering	Mr Burg	Mr Broun
SOCIAL SCIENCES	15	-European space	Mr Lavroff	Mr Machelon
		-National community	(vice president: Mr Jacque)	
		-Man and technological change	Mr Bellon	Mr Lichtenberger
TECHNOLOGY AND MANUFACTURING	70	-Mechanics, optics	Mr Lachat	Mr Richard and
			(Vice-president: Mr Imberti)	Mr Bulabois
		-Factory automation, robotics	Mr Blanchard	Mr Lhote
		-Product design	Ms Quarante	Ms de Vendeuvre
		-Ergonomics and productivity	Mr Wisner	Mr Lichtenberger
		-Electrical engineering	Mr Amiet	Mr De Vries
ELECTRONICS, COMPUTERS	80	-Advanced microelectronics	Mr Aigrain	Mr Ouannes
		-Computers		
PLANNING AND TRANSPORT RESEARCH	19	-Earthbound transport	Mr Lagasse	Mr Eurin
		-Civil engineering	Mr Chapon	Ms Brachet
NATURAL RESOURCES	9	-Living resources and forestry	Mr Cauderon	Mr Monties
		-Mineral resources development	Mr Dietrich	Mr Gony
ADVANCED MATERIALS	60		Program Committee: Mr Causse	Mr Bourgeois
		-Traditional materials undergoing change	Mr Pomey	—
		-Composites	Mr Gobin	—
		-Ceramics	Mr Sifre	—
		-Superconductors	Mr Jerphagnon	—
ADVANCED CHEMISTRY	13	-Molecular engineering	Mr Faure	Mr Blanchard
RESEARCH FOR DEVELOPMENT	10	-Environment and resources, utilization and conservation	Mr Garagnon	Mr Turenne
		-Growth, mobility, socio-economic concentration phenomena	Mr Garagnon	Mr Turenne
		-Food production, innovation, and technology transfer	Mr Garagnon	Mr Turenne

Footnotes

1. Each program is supervised by a scientific committee whose president is appointed by the minister of research and higher education. This committee ensures program orientation, issues calls for bids, implements projects, and evaluates research results.) 25041

Italy, Israel Sign Science-Technology Protocol

AU1510163788 Rome ANSA in English
0823 GMT 15 Oct 88

[Text] (ANSA) Rome, [no date as received]—A new science and technology protocol between Italy and Israel was signed at the Foreign Ministry, here on Thursday, aimed at reinforcing and boosting cooperation between the agencies and research institutes in the two nations.

In particular, the accord seeks to stimulate and expand research cooperation in the fields of bio-technology, agriculture and nutrition, medicine and health, alternative energy, and telecommunications.

The accord also calls for greater exchanges of experts. Presently, thirty Italian scientists are visiting the Weizmann Institute in Rehovot, while twenty Israeli scientists are taking part in a medical convention in the Italian capital.

Overview of Italian R&D

36980379 Milan SCIENZA OGGI in Italian
Apr 88 pp 15-31

[Article by Professor Luigi Rossi Bernardi, president of CNR [National Research Council]]

[Text] This year has again been a prolific one for Italian science, in terms of positive events, progress, and prestigious results. Outstanding among the principal events of the year that marks the 50th anniversary of the death of Guglielmo Marconi, founder and first president of the CNR, has been the awarding of the Nobel Prize for Medicine and Physiology to Professor Rita Levi-Montalcini, who for many years headed the CNR's Cellular Biology Institute, where she still carries on her work.

Following the Nobel Prizes awarded to Professor Rubbia and Professor Modigliani, Professor Levi-Montalcini's represents a third consecutive international recognition, of the highest order, honoring Italian research.

Referring to major world scientific achievements, for their revolutionary impact, the president of the CNR cited the discovery of superconductivity at high temperatures and the progress being made on the project to determine the basic sequence of the human genome and that of other living beings. In addition to the European-Community's JET project and the other international projects, progress is also being made toward producing energy in unlimited quantities through nuclear fusion. Taken all together, these projects open unprecedented and extraordinary possibilities for human progress. On the Italian front as well, scientific projects of major international import are also progressing. These include the Gran Sasso Laboratory for advanced research on nuclear physics under the aegis of the National Institute of Nuclear Physics; the Italian/ project headed by Professor Renato Dulbecco on the study of the human genome; Professor Levi-Montalcini's discoveries on the practical use of the growth factor; the third Italian Antarctic expedition under the aegis of the ENEA [National Agency for Research and Development of Nuclear and Alternative Energies] and the CNR; the "Elettra" project at Trieste, headed by Professor Carlo Rubbia, on the production of synchrotron light; the ICAROS project on building the Italian artificial heart developed jointly by FIAT and the CNR; the RFX research project at Padua on fusion, under the aegis of the CNR and ENEA; the forthcoming installation at Noto of the second station in the CNR's VLBI [Very Long Baseline Interferometry] network for radioastronomic observations; developments in Italian space research; the FIAT and Olivetti initiatives for the development of a network of research laboratories in the Mezzogiorno; the initiatives of the partially-state-owned industries—IRI, ENI and EFIM—in Italy and abroad; and new laboratories for research in the biotechnologies sector by Lepetit at Gerenzano, in microelectronics by SGS at Agrate and Catania, and in the food industries sector by SME at Caserta.

Noteworthy for its importance among the measures being instituted by the Parliament and the Administration in support of scientific research activity is the recent approval of the new work contract for the more than 16,000 researchers and employees in the non-university research sector. This is a long-awaited measure which narrows the gaps and discriminations in regard to economic and working conditions for those employed in research outside the universities, enabling the homogenization of working conditions and compensation throughout the Italian research sector, and thus constituting a first step towards stemming the exodus of this personnel from the public sector's research agencies.

The indicators that best provide a comparison between the development of the Italian scientific system and those of the other industrialized countries are shown in Table 2 [actually published as Table B]:

Table B - Resources Allocated to R&D as Ratios (in Percentages) of Indicated Economic Parameters

COUNTRY	R&D Spending as Percent of GDP						Researchers Per 10,000 Work Force Units				
	1975	1977	1979	1981	1983	1985	1975	1977	1979	1981	1983
United States	2.3	2.3	2.3	2.4	2.7	2.8	55.3	55.7	57.7	62.0	63.8
Japan	2.0	2.0	2.1	2.3	2.6	2.8	59.5	60.8	65.0	68.8	73.9
Germany	2.2	2.1	2.4	2.4	2.5	2.7	38.6	41.8	45.3	46.5	48.2
France	1.8	1.8	1.8	2.0	2.3	2.3	29.2	29.7	31.3	36.4	39.1
United Kingdom	2.2			2.4	2.3	2.2					
Italy	0.9	0.9	0.8	1.0	1.1	1.4	17.9	18.2	20.8	22.9	27.3
Canada	1.1	1.1	1.1	1.2	1.3	1.4	23.0	23.6	23.6	26.2	28.7
Spain	0.4		0.4	0.4	0.5				10.0	10.6	10.2
Australia				1.0	1.0					35.5	
Turkey											
Netherlands	2.0	1.9	1.9	2.0	2.0	2.0	30.9	34.2	35.4	37.4	36.9
Sweden	1.7	1.8	1.9	2.2	2.5	2.8	25.8	27.0	27.6	34.7	39.0
Belgium	1.3	1/3	1.4		1.5		23.0	22.8	26.4		
Switzerland	2.4	2.3	2.4	2.3	2.3		33.8	38.8	34.5		
Austria	0.9			1.2	1.2	1.3	16.5			20.1	
Yugoslavia			0.9	0.8							
Denmark	1.3	1.0	1.0	1.1	1.2	1.3	20.7	21.6	22.8	25.4	
Norway	1.3	1.4	1.4	1.3	1.4	1.5	33.4	34.1	37.1	38.0	40.9
Greece			0.2	0.2	0.3	0.3			7.8		7.9
Finland	0.9	1.0	1.0	1.2	1.3	1.5	26.1	27.6	30.4		36.6
Portugal	0.3	0.3	0.3	0.4	0.4		4.3	4.9	6.1	7.0	7.6
New Zealand	0.9	0.8	0.9	1.0	1.0						
Ireland	0.8	0.8	0.7	0.7	0.7	0.8	21.3	22.6	21.2	20.7	24.8
Iceland	0.9	0.6	0.7	0.7	0.7	0.8	22.6	27.5	29.8	31.4	35.9
Total OECD (a)	1.9	1.8	1.9	2.0	2.2	2.4	39.7	40.9	43.1	46.0	48.4
Total EEC (a)	1.6	1.6	1.6	1.8	1.8	1.9	27.1	28.4	30.2	32.0	33.8

Source: OECD/STIID Data Bank - April 1987.
Note: a) OECD estimates.

The above figures show that the gap between the Italian scientific system and those of the most advanced countries is constantly narrowing. The index represented by the ratio between budgeted outlay for research and GDP [gross domestic product] is on a steady rise in Italy, and in 1987 attained an estimated level, in the absence of actual figures, of around 1.45 percent. Figure 1 [not reproduced] shows the very significant rise of this index over the past few years versus the constantly less-than-one percent level of the 1970's. The budgeted outlay for research in 1987 totaled 13,669 billion lire—6,337 billion of which by the Government and 7,332 by public- and private-sector industries (Table 3 below).

Table 3 - 1987 Research Budget Projections (Billions of Lire)

RESEARCH SECTORS	BILLIONS	%
GOVERNMENT		
-Ministries and Services	1,507	11.0
-Research organizations (CNR, ENEA)	2,126	15.6
-Universities	2,246	16.4
-Other government agencies	458	3.4
Total	6,337	46.4
ENTERPRISES		
-ENEL	194	1.4
-State-participation enterprises	2,581	18.9
-Private enterprises	4,557	33.3
Total	7,332	53.6
Sum total	13,669	100.0

Source: IDRDS - CNR

The budgeted increment over 1986 at current prices was 22.3 percent, the real increment being estimated at 18.4 percent. Figure 2 [not reproduced] shows an incremental progression in the outlays for R&D in our country, while Table 4 below shows the distribution of budgeted outlays, by disbursing agency and by research sector, as percentages of the total.

Table 4 - Italian Public-Sector 1987 R&D Budget(*)

AGENCY	%	DISCIPLINE	%
MPI	35.4	Engineering and technologies	18.0
CNR	19.5	Biology and Medicine	14.4
ENEA	14.0	Physics	11.9
Defense	8.2	Space	11.4
Int. Contracts	5.5	Interdiscipline Research	8.5
INFN	3.7	Agrarian Sciences	7.3
Other Agencies	13.7	Other sectors	21.5

*) Public-sector spending totaled 6,337 billion lire.

Despite these gratifying advances, the president of the CNR states in his report, from the standpoint of aligning the Italian scientific system with those of the most advanced countries, the problems remaining to be resolved are many and very substantial. Development of the Italian scientific system, which is essential from the standpoint of enabling our industrial system to remain competitive in the strategic growth sectors, will require, as indispensable—and in addition to new and sizable incremental investments in research over the next several years—a considerable increase in the training of specialized personnel, whose number today is already insufficient to meet the current needs of our national industrial sector.

In addition to increasing the number of persons graduating from universities, the numbers of young persons entering doctoral studies in research, of scholarships, of work-study contracts, and of training stays abroad must all be increased, together with increased interaction among universities, business and research agencies.

The creation of a Ministry of Universities and Research—adds the president of the CNR—represents a positive step, even though it may be found necessary to substantially modify the provisions of the bill under discussion in the Senate, so as to allay fears and concerns and gain a consensus backing this law among the scientific community.

Science, Technology in Industrial Context

The viewing of science and technology as an instrument for addressing and resolving social and economic problems has produced in all countries an ongoing commitment both to the creation of new knowledge and to the improvement of technological diffusion and applications. One way of viewing R&D within the broader national context is to measure the outlay for research against the yardstick of the national economy as a whole, obtaining a ratio between the expenditure on research and development and the GDP.

Resources Devoted to R&D

World Totals: Researchers and Spending

In 1980, the sum of the funding budgeted for R&D worldwide came to around $207,801 million, while research personnel resources totaled 3,756,100 FTEU's [full-time equivalency unit('s)]. In this international context, Italian researchers represented 1.2 percent of the total, and our country's spending for R&D totaled 1.7 percent of the world total.

In 1983, as regards the more industrialized Western member nations of the OECD and the EEC nations, the number of researchers was 1.75 million FTEU's, while spending totaled $186 billion at current rates. In 1984, R&D spending totaled $205 billion; and in 1985, according to an OECD estimate, $228 billion.

OECD-EEC Totals: Researchers and Spending

As shown in Table A [not published by source], as regards the distribution of researchers in the OECD area, the United States represents 43.2 percent of the total, Japan 20.7 percent, the other OECD countries as a whole 8.3 percent, and the EEC countries 27.8 percent. In 1983, Italy, with researchers totaling 63,000 FTEU's, represented 3.8 percent; in 1984, this figure declined.

With respect to spending for R&D in 1983 in the principal OECD areas, the United States occupied a predominant position with 48.6 percent of the total, followed by Japan (15.4 percent), the EEC countries (29.1 percent), with Italy 2.9 percent, and the other countries (6.9 percent).

R&D spending as a percentage of GDP in various area and countries (Table B) shows the following trends: United States [1983] 2.7 percent (2.8 percent in 1985); Japan 2.6 percent (2.8 percent in 1985); Federal Republic of Germany 2.5 percent (2.7 percent in 1985); France 2.3 percent (2.3 percent in 1985); United Kingdom 2.3 percent (2.2 percent in 1985), Italy 1.1 percent (1.4 percent in 1985).

In 1983, the overall R&D/GDP ratio for all OECD countries was 2.2 percent (2.4 percent in 1985), while among the EEC countries it was 1.8 percent (1.9 percent in 1985).

The relative positions of the OECD countries in this ranking is somewhat distorted by the presence in some of them of major defense research programs. If, instead of measuring total R&D spending against GDP, one considers civil R&D alone, the ranking changes considerably. The average civil R&D/GDP ratio for the OECD area as a whole in 1983 was 1.8 percent, as compared with the total figure of 2.2 percent.

R&D Funding

In by far the majority of countries, the funding of R&D is provided almost in its entirety by their Governments and enterprises, the remainder being provided by international and nonprofit organizations.

During the 1980's, public and private funding sources in the United States roughly matched each other, while in Germany and Japan funding by the private sectors predominated, and in the other countries most of the funding was by the public sector. In Italy, funding by the private sector prevailed during the 1970's; in 1982, a balance was attained between public and private funding; and from 1983 onward, the previous trend was inverted.

Table C - Analysis of R&D Spending in OECD Countries (in Percentages)

COUNTRY	Sector in Which Performed				Total	Source of Funding			
	Enterprises	Government	Universities	ISSL		Enterprises	Public Sector	Other Domestic Sources	Foreign Trade
United States	71.1	12.4	13.4	3.0	100.0	49.0	48.4	2.7	
Japan	63.5	9.6	23.0	3.9	100.0	65.2	24.0	10.8	0.1
FRG	68.3	14.3	16.8	0.5	100.0	57.0	41.6	0.4	0,9
France	56.8	26.4	15.8	0.9	100.0	42.0	54.0	0.5	3.6
United Kingdom	61.3	21.7	14.0	3.0	100.0	42.0	49.5	3.0	5.5
Italy	57.1	23.6	19.3		100.0	45.1	52.4		2.5
Canada	46.9	26.9	25.0	1.2	100.0	38.6	52.2	5.0	4.2

Sources: OECD Science and Technology Indicators, No.2, Paris, OECD, 1986.
For Italy: ISRDS compilation based on ISTAT data.

Examining in more detail the figures for sources of funding in 1983 in some of the OECD countries, Table C above shows that R&D in the United States received 49 percent of its funding from private enterprise and 48.4 percent from the public sector; in Japan, these ratios were, respectively, 65.2 percent and 24 percent; in the FRG, 57 percent and 41.6 percent; in France, 42 percent and 54 percent; in the United Kingdom, 42 percent and 49.5 percent; and in Italy, 45.1 percent and 52.4 percent.

Table D - Percentage Distribution of State Funding of R&D in 1984 - By Socioeconomic Objectives

Socioeconomic Objectives	FRG	France	United Kingdom	Italy	United States	Japan
Earth's environment	2.0	1.5	1.7	1.4	1.4	1.1
Infrastructure	1.1	2.2	0.5	0.9	2.5	1.4
Land-use	1.1	1.3	1.0	0.6	0.1	1.1
Pollution	3.0	0.4	1.2	0.8	0.5	1.4
Human health	3.2	3.8	3.6	8.3	11.3	2.5
Energy	15.2	7.7	5.1	22.7	5.8	14.0
Agricultural productivity	2.1	3.7	5.0	5.0	2.1	10.9
Industrial productivity	12.0	11.1	7.1	18.2	0.2	6.1
Societal life	2.3	1.6	0.9	1.3	1.2	0.7
Space	3.9	5.6	1.8	6.4	5.2	4.4
University research	32.6	12.1	14.7	20.2	0.0(a)	51.8
Non-oriented research	11.4	14.3	6.8	5.7	3.9	1.7
Non-categorized research		1.6	0.3	0.1		
Defense	10.0	33.4	50.4	8.3	66.0	2.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

Sources: ISRDS compilation based on Eurostat data. Public Funding of Research and Development 1975-1985, Luxembourg, 1986. National Science Foundation. DSTIA-DSRS. International Science and Technology Data Update 1986, Washington, NFS.
Note: a) The Federal Government of the United States does not anticipate an objective of a general nature for R&D at universities.

Table D above, showing the percentage structure of R&D funding by the public sector, exhibits profound differences as to socioeconomic objectives sought by the larger OECD countries. R&D funding for improvement of land-use in the United States was minimal (0.1 percent), while that for medical research amounted to

almost 5,500 billion lire, or 11.3 percent of its total R&D funding (more than the total public funding of R&D as a whole in Italy).

Research devoted to energy and to improving industrial productivity received considerable public funding in the European countries and in Japan, while in the United States the improvement of industrial productivity is financed indirectly, through the funding of military research.

As regards industrial productivity objectives, the FRG accords special priority to activities aimed at improving its research, the competitiveness of its industrial sector, and its transportation facilities. The latter sector is privileged in the United Kingdom as well, while Italy accords primacy to its electronics and telecommunications sectors.

Japan is the only country that devotes 10.9 percent of its R&D funding to agriculture.

Basic or Long-Term Research

Technological developments are changing the tenuous balance between basic and applied research, between which it is often difficult to draw a dividing line. In particular, the "generic" technologies (which range from scientific speculation to commercial applications) have taken on growing importance in areas such as electronics, materials science, and the life sciences.

Basic or long-term research represents an activity of modest dimensions in the OECD countries. In 1983, in the more industrialized countries, spending in this sector totaled $35 billion (approximately 15 percent of the sum total for R&D) and employment included 250,000 researchers.

The change in government priorities, on the one hand, and the increased cost of basic research, on the other, (growing complexity of scientific instrumentation, use of data bases, and more effective security systems) posed obstacles in the way of basic research and in particular for the universities, the primary centers of this type of research. Its share of the spending, in particular during the period 1971-1983 declined from 24 percent to 12 percent in the United States, from 24 percent to 13 percent in the FRG, from 9 percent to 5 percent in the United Kingdom, and from 25 percent to 8 percent in the Netherlands. In Italy, capital spending on university-level research remained constant at 15 percent.

It can be said that the universities of the OECD countries, with the exception of the United States and Japan, have undergone a gradual erosion of their capacity for developing research.

Patents

Patents are ever increasingly being considered an indication of scientific and technological output.

The statistics relative to national and foreign patents refer to patent applications, inasmuch as these are not necessarily followed by actual issue of the patent. Among the OECD countries, the United States, the Federal Republic of Germany, and France—and in lesser measure, United Kingdom and Japan—are those with the largest concentration of producers and diffusers of technology. Countries such as Switzerland, Sweden, the Netherlands, and Belgium, besides filing a large number of patents abroad, attract foreign filers of patents. And countries such as Turkey, Yugoslavia, Portugal, and Greece produce technology principally for their domestic markets.

Technological Balance of Payments [TBP]

The TBP, an indicator of the technology transfer status among countries, measures the import-export movements of intangible technological assets in the form of rights to intellectual and industrial properties, such as patents, know-how, trademarks and technical assistance.

A cursory examination of the data compiled by the OECD concerning 16 countries, separated according to four geopolitical areas (United States, Japan, 8 EEC countries, and other OECD countries), for the period 1975-1985, shows that—except for the United States (the major vendor of technology transfers to other countries), United Kingdom, Sweden and Denmark—the OECD countries import more intangible technological assets than they export.

A characteristic common to the OECD countries is the need to integrate the results of their domestic R&D activities with imported technological know-how, and this underscores the existence of a complementarity between R&D and intangible technological assets.

Resources Devoted To Research in Italy/Financial Resources Devoted To R&D

The resources devoted to research, as a percentage of GDP, determines the growth trend of R&D investments. In the current decade, a decided recovery in overall R&D spending, and a consequent increase in its percentage of GDP, are in progress, such that the estimated figure for 1987 is 1.45 percent.

Thus, the gap between our R&D/GDP ratio and those of the other industrialized countries is gradually narrowing, although a prolonged and sizable effort will nevertheless be needed to match our R&D outlays to the requirements of an ever more advance country. The Central Statistics Institute has drawn up a revised compilation of the resources used to calculate the country's GDP,

beginning with the year 1980. This has resulted in a 15- to 17-percent revaluation of that indicator, depending on the year, and a consequent lowering of the R&D/GDP ratio for those years.

The need to increase the country's outlay, for improving socioeconomic conditions, is being felt strongly at the political level. This need is cited in the Science and Technology Committee Report (Dadda Report) on the situation and outlook for science and technology in Italy. The Report recommends as an objective, for the country's resources devoted to R&D, an R&D/GDP ratio of 3 percent.

Overall R&D funding in 1987 is estimated at 13,669 billion lire at current prices (Table E), up an estimated 22.3 percent over the spending projections of last year's Report.

Table E - 1987 R&D Spending Projections

RESEARCH SECTOR	BILLIONS OF CURRENT LIRE	%
Public Administration (a)	6,337	46.4
Government services	1,507	11.0
Research agencies (CNR and ENEA)	2,126	15.6
Universities	2,246	16.4
Other government agencies	458	3.4
Enterprises	7,332	53.6
ENEL	194	1.4
State-participation enterprises	2,581	18.9
Privately-owned enterprise (b)	4,557	33.3
Total	13,669	100.0

Source: ISRDS compilation of data from individual administrations.

Notes:

a) The Public Administration sector includes all services operated and/or managed by the Government, the CNR, ENEA, the universities, and the other public agencies involved in research; the latter rubric now includes also the research agencies defined by the Law of 20 March 1975 and subsequent revisions, as well as regional and local administrations.

b) 1987 budget figures provided by ISTAT.

The Government Administrations, research organizations, other public agencies—both regional and local—and universities plan to spend 6,337 billion lire. Public- and private-sector enterprises and ENEL plan to spend 7,332 billion lire.

On the whole, the Government appeared less dynamically inclined than the previous year: Its share of the spending was 46.4 percent of the total (in 1986 it was 48.9 percent). This decline was attributable to two major factors: The very small increase (3.1 percent at constant prices) in spending by the Government Administrations and research agencies (CNR and ENEA), and the lack of earmarking of allocations by some Ministries with high spending potentialities. The research laboratories of the Government, of regional and local government agencies, and of research organizations clearly diminished their percentages of the total spending versus 1986. On the other hand, research spending at the university level continued its uptrend in real terms with a rise of 24.3 percent. In 1987 it represented 16.4 percent of the total—a larger percentage than that of the research organizations.

The R&D spending budgets of the public- and private-sector enterprises (whose combined share amounted to 53.6 percent of the total) attest to the importance these enterprises attribute to research, development and innovation. Within this category, the largest increment was registered by the enterprises of the private sector (+25.3 percent).

In 1987, however, the partially-state-owned enterprises, with a 22.2-percent real increment over 1986, also exhibited a capacity for R&D spending growth well above that posted during the first half of the 1980's. ENEL, with a determinative 1.4-percent share of overall R&D spending, posted an 11-percent increase over 1986. Figures are not available on the IMI's 1987 R&D allocations, which in 1986 exceeded 1,000 billion lire.

The real growth of overall R&D spending during the years 1980-1985 (+10.6 percent annually), and the budgets for 1986 (+13.2 percent over 1985), attest to the exceptional financial effort being deployed by the country to achieve a wide-ranging and well-structured R&D system. It is to be noted that the GDP posted an average growth rate, in real terms, of 1.6 percent between 1980 and 1985, and of 2.7 percent in 1986.

With reference to 1985, it is noted that the Government, as a whole, performed 43.1 percent, but financed 51.8 percent, of the country's total research output, and that the enterprises performed 56.9 percent and financed 44.7 percent of the total. The Government exhibited determination on its part to sustain research at the university level and at that of the major research organizations, while spending modest sums for laboratories under its direct control. It also channeled sizable funding to the enterprises, particularly those in the public sector. The support provided by Government grants (17 percent of the total public funding) and by foreign sources (3.6 percent of the total) [this passage as published]. The total financial support provided to enterprises by foreign sources amounted to approximately one-fourth the total amount spent by the enterprises on R&D activities.

Public Funding of R&D

Government funding is channeled into the research activities carried on directly by institutions in the public sector and in the laboratories and research centers of enterprises in the public and private sectors.

During the 1980's, public funding of R&D rose sharply: From 1,134 billion lire in 1980 to 2,480 billion lire in 1985 (at constant 1980 prices), with an average annual growth rate of 13.6 percent. On the other hand, the distribution of this funding, as between Government, including the universities, and enterprises, showed a negative trend from the standpoint of the structures in the public sector, in that funding of the latter declined from 87.9 percent of the total in 1980 to 81.3 percent in 1985, although the latter funding grew at the rate of 11.8 percent annually.

Universities absorbed approximately 36 percent of public funding, 90 percent of which was provided directly by Government Administrations, and the remaining 10 percent by Government research agencies (primarily, the CNR).

From 1980 through 1985, the funding of major research agencies, such as the CNR and ENEA, grew at a rate of a little over 10 percent per annum, a relatively modest rate if one considers that these agencies, in turn, finance research projects in universities, in other public agencies, and in enterprises.

Table F - Public Funding of Public Sector Research Agencies (Except Universities) in 1985 - By Socioeconomic Objectives

OBJECTIVE	MILLIONS OF LIRE	%
Agricultural productivity and technologies	158,807	7.5
Industrial productivity and technologies	107,837	5.1
Energy production and distribution	927,176	43.5
Transportation and telecommunications	2,298	0.1
Urban and rural planning	1,729	0.1
Environmental protection	32,135	1.5
Protection and improvement of human health	262,806	12.3
Social development and social services	36,557	1.7
Land exploration and use	67,123	3.2
General advancement of know-how	476,548	22.4
Space exploration and use	9,325	0.4
Defense	48,126	2.3
Total	2,130,467	100.0

Source: ISRDS compilation based on ISTAT data.

A recapitulation of actual spending as of 1985 (Table F above) shows that—excluding the university sector—the Government accorded primacy to the production and distribution of energy (43.5 percent of total public funding), the general advancement of know-how (22.4 percent), the protection and advancement of human health (12.3 percent), while defense-oriented research received 2.3 percent of the total funding.

However, the sector that during the same period marked the growing interest of the Government in R&D activities and technological innovation closely supportive of the country's economy was that of the enterprises.

The enterprises, for their part, while maintaining their rate of reinvestment (70 percent), are benefiting increasingly from governmental participation.

In addition, since 1970, the IMI fund has become a substantial component in the financing of applied research, to the extent that in 1980 this source represented 5 percent of the financial resources available to the enterprises for research. In 1986, the fund disbursed over 1,000 billion lire.

That public funding is tending toward improving industrial competitiveness is attested to by the fact that in 1985 [see Table L below] the products that benefited the most from this source were in the advanced-technology sector, consisting principally of vehicles and materials for aerospace transport (28.4 percent of public funding to enterprises), other transport vehicles and materials (11.2 percent), radiotelecommunications equipment (15.7 percent), and data processing machines (8.7 percent). The IMI accorded top priority to radiotelecommunications equipment (21.6 percent of its entire disbursement for the year) and data processing machines (19.6 percent).

Table L - Public Funding of Enterprises Sector in 1985 - By Science Disciplines and Products

SCIENCE DISCIPLINES AND PRODUCTS	PUBLIC ADMINISTRATION			
	Total		Including by IMI	
	Millions of Lire	%	Millions of Lire	%
Exact, physical and natural sciences	102	0.0	—	—
Engineering sciences	3,836	0.4	921	0.2
Medical sciences	170	0.0	170	0.0
Other science disciplines	50,491	5.7	27,914	7.3
Live animals and products of animal and vegetable kingdoms	3,600	0.4	—	—

Table L - Public Funding of Enterprises Sector in 1985 - By Science Disciplines and Products

SCIENCE DISCIPLINES AND PRODUCTS	PUBLIC ADMINISTRATION			
	Total		Including by IMI	
	Millions of Lire	%	Millions of Lire	%
Food industry products; beverages; tobaccos	1,035	0.1	945	0.2
Mineral extraction	7,514	0.9	162	0.0
Chemical industry products	68,165	7.8	49,467	12.9
Artificial plastic materials and rubber	6,076	0.7	2,971	0.8
Skins, leathers, furs, etc.	28	0.0	—	—
Lumber and cork	1,326	0.2	—	—
Paper manufacture, publishing industry	746	0.1	746	0.2
Textile materials and manufactures	3,121	0.4	2,772	0.7
Footwear, hats, etc.	40	0.0	—	—
Processing of nonmetallic minerals	425	0.0	—	—
Common metals and their products	17,315	2.0	7,057	1.8
Boilers, mechanical machines and equipment	155,081	17.6	115,398	30.2
- including data processing machines	(76,788)	(8.7)	(74,830)	(19.6)
Electrical machines, equipment and materials	182,935	20.8	112,337	29.4
- including radiotelecommunications machines	(138,107)	(15.7)	(82,696)	(21.6)
Transportation materials	348,603	39.6	52,977	13.9
- including aerospace transportation machines	(250,125)	(28.4)	(20,951)	(5.5)
Optical and medico-surgical equipment	13,141	1.5	8,531	2.2
Arms and munitions	15,619	1.8	—	—
Total	879,369	100.0	382,368	100.0

Source: ISRDS compilation based on ISTAT data.

Funding of R&D in Public Sector

By Agencies (Figure G [not published by source])

The budgets of public agencies and ministries, subdivided according to sectors by disciplines, show an increase for 1987 of 15.8 percent—or in real terms, 12 percent—over the preceding year.

In particular, the budget of the Ministry of Education (which represents 35.4 percent of the public sector) increased 28.5 percent, and the CNR's 35.8 percent. In the case of the latter, funding for normal operations rose by 19.2 percent, while that earmarked for the National Space Plan doubled. The CNR had at its disposal approximately one fifth of the appropriations for the public sector.

The ENEA, on the other hand, with projected expenditures totaling almost 900 billion lire, suffered an 18-percent cutback in its funding, attesting to a "wait-and-see" situation as regards governmental energy policy choices.

The Defense Ministry's R&D 1987 funding resources were also cut back (-4.8 percent). On the other hand, increased funding was provided by the Ministry of Agriculture and Forests (+30.11 percent), Ministry of Public Health and Ministry of Cultural Assets (Over 67 billion lire), the INFN [National Institute of Nuclear Physics], which with its 233 billion lire covers 4 percent of the public sector's R&D spending budget, and by the Higher Institute of Public Health with an increase of 3.5 percent.

The other highly specialized and qualified research agencies, although smaller in size, in terms of human and financial resources, benefited from budgetary increases.

As for the other ministries, one of which is the Ministry for Special Funding of the Mezzogiorno, which also disburse sizable sums for R&D—on R&D projects carried out in their own laboratories, on programs stipulated by law, and on projects contracted for outside their own facilities—details of their R&D budgets have not been made available.

Insofar as concerns investments in the southern regions, however, it must be pointed out that, although they cannot be included in the calculation of the sum total of R&D spending, the initial "program agreements" with the public enterprises (IRI) and private ones (Olivetti and FIAT), and with the scientific institutions (CNR), involve total commitments over the 3-year period amounting to approximately 8,000 billion lire. These "program agreements" have to do with industrial initiatives involving technological innovational, applied research, and developmental projects. Not to be overlooked, also, are the contributions made to international organizations for participation in joint programs, such as, for example, 232 billion lire to the European Space Agency.

Table H - Distribution of Public Sector Spending for Research in 1987 - By Science Discipline Sectors and Agencies

Discipline sector	Ministries of				Other ministries						Other	Inter-national	Public sector	Percent
	Public education	Defense	Agri-culture	Health	and Institutes	Regions	CNR	ENEA	INFN	ISS	research institutes	contri-butions	total	
Mathematics	119,038	261					13,936				255		133,490	2.1
Physics	177,434	7,830			16,530	18,946	80,971	114,738	233,320	2,954	17,487	85,375	755,585	11.9
Chemistry	213,370	5,220			930	1,283	63,516	8,293		18,315	1,423	420	312,770	4.9
Biology and medicine	606,420	1,566		129,042	26	18,617	70,791	17,625		37,222	14,044	15,295	910,648	14.4
Geology and minerals	74,118				500	563	44,975				14,155	70	134,363	2.1
Agriculture	226,846		67,580		82,622	10,703	39,832	14,258			15,302	6,623	463,766	7.3
History, philosophy, philology	222,354				22,915	700	16,472					781	263,222	4.2
Journalism, political science	168,450				1,742		10,662				50	350	181,254	2.9
Economics, sociology, statistics	101,070				33,000	4,660	8,042				15,473	1,383	163,628	2.6
Nuclear research		783						441,503			953		443,239	7.0
Space research		10,540			77,966		400,000(e)					232,200(h)	720,706	11.4
Engineering & technological research	336,900	482,750			54,113	2,930	104,775	136,545		591	23,044	14	1,141,662	18.0
Interdiscipline research		13,050			147,079	2,704	210,000(f)	154,431			2,133	8,652	538,049	8.5
Miscellaneous expenses							174,634						174,634	2.8
Total spending	2,246,000 (a)	522,000	67,580	129,042 (b)	437,423 (c)	61,106 (d)	1,238,588	887,393	233,320	59,082	104,319 (g)	351,163	6,337,016	100.0
Percentage of total	35.4	8.2	1.1	2.0	6.9	1.0	19.5	14.0	3.7	0.9	1.6	5.5	100.0	

Source: ISRDS compilation based on data from individual administrations.

Notes:

a) 1987 spending budget figures were provided by ISTAT.

b) Increased availability of funding for 1987 is owing in part to a refinement in the sources of data and in the methodology used to compile the data.

c) Reports were not received from the Ministries of Merchant Marine, Transport, Public Works, Foreign Affairs, and Special Funding of the Mezzogiorno. Data relative to 1986 were used for the Mezzogiorno Fund and the Ministry of Public Works.

d) For this year, the following Regions provided information on their research activities: Emilia Romagna, Lombardy, Alto Adige, Veneto, Liguria, Valle d'Aosta, and Friuli.

e) This allocation consists of the Government grant-in-aid for space research.

f) This allocation consists of the funds appropriated for Targeted Research Projects.

g) This column includes the other public-sector R&D and experimentation agencies provided for by Law 70 of 20 March 1975.

h) This amount is covered by Chapter 8251 in the Ministry of Foreign Affairs budget under the rubric "Contribution to the European Space Agency (ESA)."

By Sectors According to Disciplines

Analyzing the sectorial distribution of R&D spending by science disciplines (Table H above), one finds that engineering and technological research absorbed 18 percent of the total for 1987, with sizable contributions by the Ministries of Defense and Education. Other sectors receiving sizable amounts of funding are those of space research (11.4 percent), the physical sciences (11.9 percent of the total), and biological and medical sciences (14.4 percent of the total). The latter represents a substantial increase (+48.5 percent over 1986) provided by allocations from the Education and Public Health Ministries' budgets, and thus a continuation into 1987 of the trend in the Italian public sector's research effort towards according priority to those disciplines that can exert an economic and social impact.

Contributions to nuclear research (7 percent of the total) showed a sharp decline stemming from the cutback in appropriations to the ENEA; and contributions to interdisciplinary research declined owing to the meager increase in funding of the CNR Targeted Projects and to the lack of programs in this sector involving financing by the Mezzogiorno Fund.

Funding According to Socioeconomic Objectives (NABS) (Table L [actually published as Table M]):

Table M - Distribution of Spending Among Public Agencies, ENEL, and State-Participation Enterprises in 1987 - By Socioeconomic Objectives - (in Millions of Lire)

Objectives	Ministries of				Other ministries and institutes	Regions	CNR	ENEA	INFN	ISS	Other Research institutes	International contributions	Public sector total	ENEL	State-owned enterprises	Overall total	%
	Public education	Defense	Agriculture	Health													
Earth's environment					4,522	2,339	72,005				28,856	451	108,173		59,787	167,960	1.8
Land-use					11,160	3,084	31,404					7	45,655		120,856	166,511	1.8
Environmental pollution					2,732	3,112	32,800	50,446		17,134	9,917	159	116,300	19,400	15,703	151,403	1.7
Human health				129,042	375	18,567	128,574	80,194		38,403	9,438	9,838	414,431		1,200	415,631	4.6
Energy					18,039	17,623	83,675	644,920					764,257	175,100	155,880	1,095,237	12.0
Agriculture			67,580		78,611	10,559	77,437	14,258		2,363	19,285	8,702	278,795		15,925	294,720	3.2
Industry					251,857	1,118	167,029	97,575			18,453	2,549	538,581		1,366,787	1,905,368	20.9
Societal life					68,964	3,385	35,971				16,288	2,994	127,602		420	128,022	1.4
Space							422,888					232,200	655,088		247,507	902,595	9.9
University research	2,246,000												2,246,000			2,246,000	24.6
Non-oriented research					185	450	130,899		233,320		2,082	94,263	461,199		18,915	480,114	5.3
Not categorized					978	869	55,906			1,182			58,935			58,935	0.6
Defense		522,000											522,000		577,689	1,099,689	12.1
Total	2,246,000	522,000	67,580	129,042	437,423	61,106	1,238,588	887,393	233,320	59,082	104,319	351,163	6,337,016	194,500	2,580,669	9,112,185	100.0

Source: ISRDS compilation based on data from individual Administrations.
Note: *) NABS = Nomenclature for Analysis of Science Budgets (EEC classification).

As regards the CNR: If one excludes university research (24.6 percent of the sum total of R&D allocations in Italy for 1987), considered as a single objective although internally subdivided into sectors by disciplines, the research done by the components of this Agency, classified according to NABS objectives, shows the share of funding allocated to advancement of industrial activities to have been 13.5 percent of the Agency's total budget, that allocated to human health research 10.4 percent, and that to basic research 10.6 percent.

With reference to the governmental-and-public-enterprise sector as a whole, its top-priority objectives remain those of 1986: Advancement of industrial activities (20.9 percent), defense (12.1 percent), and energy (12 percent).

In 1987, space activities took on greater importance, with a 9.9-percent share of public funding for R&D, and increased funding by private enterprise and state participation.

The public health sector (4.6 percent) also benefited from increased public funding, as did also research on environmental pollution, owing in the latter case to ENEA's greater commitment to this end.

Still notably underrated are objectives such as the terrestrial environment, territorial improvement, and societal life.

ENEL and the state-participation enterprises allocate sizable portions of their R&D investments to the objective in others [as published], and the latter allocate over one fifth of their investments to defense.

Spending by Type of Research

Pure Research

The share of spending for this type of research, 90 percent of which was done by public-sector organizations, rose at the rate of 12 percent annually between 1980 and 1985.

Applied Research

This type received 40 percent of the public and private funding for research, at an average annual growth rate of 9.5 percent.

Experimental Development

Funding of this sphere of activity grew at the rate of 10 percent per annum over a period of 7 years. The major portion of this funding has come from the Government, which in 1985 allocated to it 25 percent of its total. The enterprises have consistently devoted to it over 50 percent of their R&D investment, with a peak of 62.5 percent in 1982.

Spending by Geographical Areas (Table N)

Table N - Distribution of R&D Spending by Government and Enterprises in 1985 - By Regions and Geographical Areas

REGIONS AND AREAS	Public Administration Sector				Enterprises Sector			Overall
	Government	Research agencies	Other	Total	Public	Private	Total	total
Piedmont	3,629	53,845	29,372	86,846	400,537	1,031,855	1,432,392	1,519,238
Valle d'Aosta			52	52	4,956	873	5,829	5,881
Lombardy	3,196	74,763	135,093	213,052	706,942	1,173,175	1,880,117	2,093,169
Trentino-Alto Adige		3,771	8,594	12,365	27	17,869	17,896	30,261
- Bolzano		1,558	662	2,220		14,315	14,315	16,535
- Trento		2,213	7,932	10,145	27	3,554	3,581	13,726
Veneto	2,033	34,801	20,398	57,232	17,639	170,402	188,041	245,273
Friuli Venezia Giulia	12,051	894	14,499	27,444	37,221	48,640	85,861	113,305
Liguria	4,091	25,206	35,431	64,728	163,807	103,215	267,022	331,750
Emilia Romagna	1,707	495,682	30,653	528,042	30,158	201,465	231,623	759,665
Total Northern Italy	26,707	688,962	274,092	989,761	1,361,287	2,747,494	4,108,781	5,098,542
Total Northwest Italy	(10,916)	(153,814)	(199,948)	(364,678)	(1,276,242)	(2,309,118)	(3,585,360)	(3,950,038)
Total Northeast Italy	(15,791)	(535,148)	(74,144)	(625,083)	(85,045)	(438,376)	(523,421)	(1,148,504)
Tuscany	19,456	100,217	20,347	140,020	73,244	80,988	154,232	294,252
Umbria	394	5,667	579	6,640	5,645	9,965	15,610	22,250
Marche	13	2,677	13,719	16,409	3,967	11,345	15,312	31,721
Latium	53,274	583,571	227,646	864,491	236,743	328,778	565,521	1,430,012
Total Central Italy	73,137	692,132	262,291	1,027,560	319,599	431,076	750,675	1,778,235
Abruzzi	287	2,281	2,523	5,091	25,994	25,113	51,107	56,198
Molise	5		530	535				535
Campania	8,560	39,618	17,173	65,351	140,639	43,163	183,802	249,153
Apulia		14,991	10,378	25,369	13,768	22,340	36,108	61,477
Basilicata		19,520	52	19,572	11,233		11.233	30,805
Calabria		4,428	1,875	6,303	350	7,079	7,429	13,732
Sicily	1,579	16,213	13,061	30,853	33,468	12,405	45,873	76,726
Sardinia		3,925	6,686	10,611	5,112	768	5,880	16,491
Total Southern and Insular Italy	10,431	100,976	52,278	163,685	230,564	110,868	341,432	505,117
Sum Totals	110.275	1,482,070	588,661	2,181,006	1,911,450	3,289,438	5,200,888	7,381,894(a)

Source: ISRDS compilation based on ISTAT data.
Note: a) Exclusive of R&D spending by universities.

The public-sector figures for 1985 show that the largest share of R&D spending goes to central Italy (47.1 percent), followed by northern Italy (45.4 percent), and lastly the Mezzogiorno (7.5 percent).

The research agencies (CNR and ENEA) cover 68 percent of the spending, with a spending distribution tied to the presence of research organizations in the regions; the other research agencies cover 27 percent; and all allocate approximately equal shares of their respective R&D investments to northern and central Italy, devoting only a meager share to the Mezzogiorno.

In the public and private enterprises sector, the figures show a 79-percent ratio of spending in northern Italy, a more contained level (14.4 percent) in central Italy, and 6.6 percent in southern Italy. However, the public enterprises show a more balanced distribution (71.2 percent in the north, 16.7 percent in the central part, and 12.1 percent in the south) as compared with the private enterprises (83.5 percent in the north, 13.1 percent in the central part, and 3.4 percent in the Mezzogiorno).

At the regional level, Lombardy covers over one fourth (28.3 percent) of the total spending for R&D, and Piedmont and Lazio one fifth (20.6 percent and 19.4 percent respectively). In the two northern regions, private research predominates; in Lazio, public research.

Nevertheless, two thirds of all research done in the country, not including university research, is concentrated in three regions.

Human Resources Devoted to R&D: Some Problems

Quantity and quality of the research personnel are important factors that pose a number of problems ranging from training to actual recruiting of the researchers. In a present-day advanced economic system, it is essential to be able to quantify projections of supply and demand, and to bring about a balance between the two. Young persons should begin learning research at the higher secondary school level, so as to develop an interest in it and be able later to choose the activity in which they wish to work.

Research Personnel in Italy (Tables P, Q, R)

Between 1967 and 1985, research personnel rose from a total of 61,000 FTEU's to 118,000 FTEU's, merely doubling, versus a tripling of spending. As for the 1987 forecast, projections are incomplete for lack of figures relative to the scientific and technological personnel of the various ministries and agencies.

Table P - Research Personnel in Italy (in FTEU's)*

YEAR	SECTOR OF ACTIVITY			JOB CLASSIFICATION		
	Public sector	Enterprises	Total	Researchers	Technicians	Other
1967	31,466	29,725	61,191	21,826	18,047	21,318
1968	33,803	32,391	66,194	24,424	19,195	22,575
1969	35,155	34,854	70,009	25,363	22,092	22,554
1970	36,989	38,387	75,376	27,618	23,867	23,891
1971	39,473	41,388	80,861	30,885	26,501	23,475
1972	44,883	41,060	85,943	32,592	28,457	24,894
1973	46,798	39,633	86,431	33,313	27,278	25,840
1974	47,723	38,932	86,655	34,308	26,549	25,798
1975	54,315	40,371	94,686	37,925	27,494	29,267
1976	56,241	39,434	95,675	37,748	27,568	30,229
1977	57,454	39,891	97,345	39,718	28,204	29,423
1978	60,073	41,793	101,866	40,779	30,376	30,711
1979	47,988	46,655	94,643	46,442	27,528	20,673
1980	47,682	48,121	95,803	46,999	27,605	21,199
1981	52,468	50,368	102,836	52,060	29,385	21,391
1982	56,027	49,900	105,927	56,707	28,027	21,193
1983	61,239	51,504	112,743	63,021	28,694	21,028
1984	60,013	52,871	112,884	61,979	30,480	20,425
1985	61,665	56,222	117,887	63,759	33,058	21,070

Source: ISRDS compilation based on ISTAT data.
Notes:
FTEU = full-time equivalency unit.
The public sector includes the research agencies, the Government services, and the universities. The enterprises sector includes the public- and private-sector enterprises.

Table Q - Science and Technology Personnel in Public Sector and State-Participation Enterprises in 1987

JOB CLASSIFICATION	State & regional (a)	CNR	ENEA	INFN	ISS	Other research institutes (b)	ENEL (c)	State-owned enterprises	Total
Researchers	1,874	2,779	1,563	427	325	420	857	7,974	16,219
Technicians	1,672	1,570	1,899	453	224	331	526	6,389	13,064
Other	1,363	1,146	530	184	522	214	525		4,484
Total	4,909	5,495	3,992	1,064	1,071	965	1,908	14,363	33,767

Source: ISRDS-CNR
Notes:
a) Science and technology personnel of the following Ministries are not included: Education (including university professors); Merchant Marine; Transport and Telecommunications; Interior; Foreign Affairs; and Special Funding for the Mezzogiorno. Reports were not received from the foregoing Ministries.
The following Regions provided the data regarding R&D personnel included in these totals: Friuli Venezia Giulia, Valle d'Aosta; Veneto, Liguria, Lombardy, Emilia Romagna, and the Autonomous Province of Bolzano, Alto Adige.
b) Including the other public-sector research and experimentation agencies provided for in Law 70/75.
c) Including the personnel of the CESI, CISE, ISMEZ, and PHOEBUS companies.

Table R - Personnel Employed in Research as of 30 June 1985 - By Job Classification, Sector, and Type of Research

RESEARCH SECTORS AND TYPES	FULL-TIME PERSONNEL			PART-TIME PERSONNEL (in FTEU's)		TOTAL PERSONNEL
	Researchers	Technicians	Other	Researchers	Technicians	
			PUBLIC ADMINISTRATION (a)			
Government Services (b)						
- Basic research	243	241	150	4	1	639
- Applied research	592	383	655	214	242	2,086
- R&D	39	116	158	59	88	460
Total	874	740	963	277	331	3,185
Research Agencies (c)						
- Basic research	1,659	1,338	571	(e)	(e)	3,568
- Applied research	1,791	1,386	576	(e)	(e)	3,753
- R&D	2,223	1,022	419	(e)	(e)	3,664
Total	5,673	3,746	1,566	(e)	(e)	10,985
Other Public Agencies (d)						
- Basic research	8,125	954	2,833	8,197	2,391	22,500
- Applied research	7,693	2,084	3,568	6,601	2,359	22,305
- R&D	983	102	454	874	277	2,690
Total	16,801	3,140	6,855	15,672	5,027	47,495
Total Public Administration						
- Basic research	10,027	2,533	3,554	8,201	2,392	26,707
- Applied research	10,076	3,853	4,799	6,815	2,601	28,144
- R&D	3,245	1,240	1,031	933	365	6,814
Total	23,348	7,626	9,384	15,949	5,358	61,665
			ENTERPRISES			
Public Enterprises						
- Basic research	81	81	35	7	20	224
- Applied research	2,915	2,356	1,226	352	288	7,137
- R&D	4,058	2,239	1,612	355	1,219	9,483
Total	7,054	4,676	2,873	714	1,527	16,844
Private Enterprises						
- Basic research	202	139	82	56	10	489
- Applied research	6,658	4,333	2,989	563	513	15,056
- R&D	8,376	7,657	5,742	839	1,219	23,833
Total	15,236	12,129	8,813	1,458	1,742	39,378
Total Enterprises						
- Basic research	283	220	117	63	30	713
- Applied research	9,573	6,689	4,215	915	801	22,193
- R&D	12,434	9,896	7,354	1,194	2,438	33,316
Total	22,290	16,805	11,686	2,172	3,269	56,222
			TOTALS BY TYPES OF RESEARCH			
- Basic	10,310	2,753	3,671	8,264	2,422	27,420
- Applied	19,649	10,542	9,014	7,730	3,402	50,337
- R&D	15,679	11,136	8,385	2,127	2,803	40,130
Sum Totals	45,638	24,431	21,070	18,121	8,627	117,887

Source: ISTAT, 1987.

Notes:

a) Included are data for the university sector based on annual estimates by ISTAT.

b) Includes Ministries and Regional Administrations.

c) Includes CNR and ENEA.

d) Includes personnel of universities, INFN, and the other research agencies.

e) Data not available.

As for the CNR, its 1987 budget calls for a total of 7,178 personnel units. In particular, the activation of its 10 third-generation Targeted Research Projects calls for 1,200 new personnel units for specified periods: 690 for CNR (90 "Article 36" units + 600 holders of scholarships), and approximately 500 for the enterprises and other participating entities (Table S).

Table S - New Research Personnel in Connection With CNR Targeted Projects

TARGETED PROJECTS	CNR		Third-Party
	Art. 36(a)	Scholarships	Contractors
Telecommunications	4	30	20
Robotics	4	70	70
Optoelectronic Technologies	9	40	20
Fine Chemicals	8	100	100
New Materials	12	100	80
Superconductive and Cryogenic Technologies	9	46	49
Internationalization of Enterprises	7	43	20
Parallel-Computer Data Processing	10	80	50
Biotechnology	9	70	50
Building Construction	15	30	50
Total	87	609	509

Source: CNR. 1987 budget.
Note: a) Qualified researchers hired on basis of 2-year renewable contract subject to a maximum duration of 5 years.

An analysis of the research personnel situation as regards the public-sector organizations shows clearly the presence of negative factors such as aging, owing to hiring freezes and the lack of mobility, and the uneven distribution, as between male and female, of the researcher and technician populations.

In the enterprises sector, on the other hand, of the 62,363 personnel units in research activities in 1985, 66 percent were employed in northwest Italy, particularly Piedmont and Lombardy, versus the proportions employed in central and southern Italy.

Public Scientific Institutions

National Research Council

In 1987, the National Research Council, the largest national scientific agency, in terms of duties, budget and personnel, continued its policy of developmental activities in pursuit of its institutional objectives and with a view to maintaining and upgrading its research structures.

Table T - Government Funding of CNR From 1980 to 1987 (Billions of Lire)

Funded Budgets	1980	1981	1982	1983	1984	1985	1986	1987
				At Current Prices				
General Expenses	246	310	310	369	365	412	533(a)	590
Targeted Projects	80	105	105	131	180	188	203	210
National Space Plan	32	38	26	50	145	200	187	400
Total	358	453	441	550	690	800	923	1,200
				At 1980 Prices (GDP Deflator)				
General Expenses	246	262	225	232	209	216	259	275(*)
Targeted Projects	80	89	76	82	103	99	99	98(*)
National Space Plan	32	32	19	31	83	105	91	186(*)
Total	358	382	320	346	394	420	448	559(*)

Source: CNR budgets for various years.
Notes:
a) Includes funding of FIO in the amount of 38 billion lire.
*) Budgetary projections.

Table U - CNR 'Third-Generation' Targeted Research Projects (Millions of Lire)

PROJECTS	YEARS					Totals
	1987	1988	1989	1990	1991	
Building Construction	12,814	17,100	28,062	29,832	27,545	115,354
Optoelectronic Technologies	9,857	10,688	11,685	10,951	9,771	52,952
Superconductive and Cryogenic Technologies	4,929	11,368	14,366	7,836	—	38,498
Robotics	8,871	11,076	15,133	15,388	17,309	67,777
New Materials	9,857	17,197	24,423	20,297	12,842	84,617
Data Processing Systems	11,829	12,242	12,642	13,122	13,586	63,422
Internationalization of Enterprises	1,971	2,429	2,969	3,210	—	10,579
Biotechnologies	15,771	16,226	16,857	17,465	18,053	84,372
Telecommunications	11,829	13,797	20,017	15,483	17,402	78,527
Fine Chemicals	17,743	18,540	19,190	19,860	20,554	95,887
Totals	105,471	130,664	165,344	153,444	137,062	691,985

Source: Interministerial Committee for Economic Planning (CIPE).

For 1987, the CNR received appropriations totaling 1,200 billion lire (Table T)—aside from funding for its 10 new Targeted Projects (for which over 105 billion lire are to be spent in 1987 (Table U)), funding for special subsidies in the Mezzogiorno, and all funding resulting from agreements with other ministries and agencies or requested from the FIO [Employment Investment Fund] for construction projects. In particular, these other fundings include approximately 226 billion lire (Law 64/1986), following the program agreement reached between the Ministry of Scientific Research and Technology (MRST) and the Ministry for Special Funding of the Mezzogiorno to finance the CNR developmental plan in the southern region. This plan calls for an increase in the number of personnel and in the organizational structures until attainment of 40 percent of the total budgeted spending in the early 1990's.

As regards spending commitments, the Agency has assumed a doubling of the budget by 1991, based on data obtained from the MRST and the recommendations contained in the "Dadda Commission" Report.

The 1987 budget provides 270 billion lire for staffing, up 50 billion (+18 percent) over the preceding year, to cover automatic salary increases and increased staffing (to exceed 7,000 staffing units in service).

National Space Plan (PSN)

The National Space Plan was instituted in 1979 to impart greater impetus to the sector and a more significant Italian presence within the ESA [European Space Agency]. Space activity has been managed by the CNR for the past 20 years, through its Space Activities Service. The CNR-managed PSN is based on 5-year planning cycles with periodic updating. The third 5-year plan (1987-1991) has now been approved, calling for the instituting of new projects, in addition to proceeding with development of activities already in progress or in their completion phase.

The programs already in their implementation phases are: The ITALSAT telecommunications satellite; the IRIS perigee booster system; the LAGEOS II geodetic satellite; the Tethered Satellite system; and the SAX scientific satellite for astronomy.

It also manages programs connected with earth observation systems (ranging from remote sensing to space geodesy), basic and technological research programs, operational activities of the Matera geodetic station, and stratospheric balloon launchings from Trapani-Milo Base.

The PSN maintains institutional relations with NASA and with the space agencies of other countries.

Overall funding of the spectrum of space activities for 1987 totals 400 billion lire. For the period 1987-1991 (Figure V [not published by source]), distribution of the funding allocates 30.5 percent of the total to telecommunications satellites, 21.4 percent to space structures and scientific satellites, 9.2 percent to earth and environmental observation programs, 9.1 percent to the space station, 7.8 percent to propulsion, 6.3 percent to space sciences, 3.8 percent to feasibility studies of future projects, 3.6 percent to technological research, and 8.3 percent to other activities.

National Committee for Research and Development of Nuclear and Alternative Energies (ENEA)

The ENEA's plan of activities for 1987 is to be implemented under the fifth 5-year plan and is concerned with the development of programs already in progress. Pending a governmental decision on the energy policy to be implemented and the consequent decisions on funding, this Agency has scaled down that part of its programs concerned with fission (thermal reactors, Cirene, fast reactors, fuel cycle and PEC).

The ENEA's sphere of activities includes the furthering and instituting of incentives aimed at rationalizing the use of energy and the application of renewable energy sources. With respect to the latter, the ENEA manages, jointly with the CNR, the PFE [Energy Targeted Project], in which it participates financially. By agreement with the CNR, the ENEA also manages the National Antarctica Project. "Agrobiotechnology" represents a new sector to which this Agency contributes funding.

For 1987, the ENEA, which employs approximately 4,000 research and technical personnel units, has based its planning on a budget of approximately 900 billion lire, devoted for the most part to the energy sector, then, in descending order of priority, the industrial sector, the human health sector, environmental pollution, and agriculture (Table M).

National Institute of Nuclear Physics (INFN)

The INFN furthers, coordinates and performs scientific research in the field of subnuclear physics, basic nuclear physics, and the physics of fundamental interactions. It also furthers technological development stemming from these sectors of activity.

Its activity—staffed by 1,200 personnel units, including over 400 researchers—is carried on principally in the three national laboratories (Frascati, Legnano, Catania) and in the 14 sections stationed for the most part at the Physics Institutes of the various universities. The INFN's activities are organized on the basis of 5-year plans approved by the CIPE [Interministerial Committee for Economic Planning]. Parliament approved funding to the INFN for its 1984-1988 Plan in the amount of 964.4 billion lire. Its 1987 appropriation was approximately 233 billion lire.

Higher Institute of Public Health (ISS)

The Higher Institute of Public Health is the principal organization through which the Government subsidizes research in and the monitoring of the field of public health, and the ISS's research activity is concerned strictly with the problem of targeted public health research; that is, it is oriented towards attainment of the objectives of the SSN [National Public Health Service]. The ISS is staffed by approximately 1,400 permanent personnel units, including some 300 researchers and research project managers.

In 1987, the ISS received R&D appropriations totaling over 59 billion lire, all devoted to the protection and furthering of human health and to the fight against and prevention of environmental pollution. It also received financing in the amount of 9 billion lire principally from the CNR, the Ministry of Foreign Affairs, the Regions, and international organizations.

Other Research Agencies

The Institute for Study of Economic Trends (ISCO), the Institute for Economic Planning Studies (ISPE) and the Institute for the Development of Workers Occupational Training (ISFOL) carry on their research activities in the socioeconomic sector, employing a total of 231 researcher and technician units. The 1987 R&D spending budgets of these three Institutes totaled 15.6 billion lire, up 12.5 percent over the preceding year (Tables Z [not published by source; see Table 7]).

Table 7 - Financial Resources and Personnel Employed by Other Research Agencies in 1987 - By Socioeconomic Objectives

OBJECTIVES	ISPE	INN	IEIGF	ING	INEA	INSEA	Inst. of higher math.	OGS	INO	ISFOL	ENSEI	SPEL	INBS	Nat'l Inst. of social medicin	Total	%	
Earth's environment	-	-	-	-	14,701	-	-	-	14,155(d)	-	-	-	-	-	-	28,856	27.7
Land use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Environmental pollution	-	-	19	2,500	-	-	-	-	-	-	-	-	7,398	-	-	9,917	9.5
Human health	-	-	5,896	-	-	-	-	-	-	-	-	-	3,288	-	254	9,438	9.0
Energy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agriculture	-	-	2,691	-	-	7,784	-	-	-	-	-	5,650	-	3,160	-	19,285	18.5
Industry	-	-	300	9,439	-	-	2,000	-	-	5	-	-	6,709	-	-	18,453	17.7
Societal life	6,539	7,865	704	-	-	-	-	-	-	-	1,180	-	-	-	-	16,288	15.6
Space	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-oriented research	-	-	-	-	-	-	-	255	-	1,827	-	-	-	-	-	2,082	2.0
Non-categorized research	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Defense	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals	6,539	7,865	9,610	11,939	14,701	7,784	2,000	255	14,155	1,832	1,180	5,650	17,395	3,160	254	104,319	100.0

Table 7 - Financial Resources and Personnel Employed by Other Research Agencies in 1987 - By Socioeconomic Objectives

OBJECTIVES	ISPE	INN	IEIGF	ING	INEA	INSEA	Inst. of higher math.	OGS	INO	ISFOL	ENSE	ISPEL	INBS	Nat'l Inst. of social medicin	Total	%	
Researchers	50	39	39	41	16	26	12	-	32	15	42	14	80	8	6	420	43.5
Technicians	12	31	31	33	16	26	-	-	42	5	16	28	78	3	10	331	34.3
Other research personnel	11	22	21	27	22	17	-	3	27	4	8	12	36	4	-	214	22.2
Totals	73	92	91	101	54	69	12	3	101	24	66	54	194	15	16	965	100.0

Source: ISRDS-CNR.
Notes:
a) Exclusive of 461 million lire of CNR and ENEA contracts. [as published: not cross-referenced in Table]
b) Exclusive of CNR funding. [as published: not cross-referenced in Table]
c) 28 researchers not on permanent staff. [as published: not cross-referenced in Table]
d) Exclusive of CNR and ENEA contracts.

Two agencies operate in the geophysics sector: OGS [Experimental Geophysics Observatory] and ING [National Geophysics Institute].

The OGS, based in Trieste, employs some 100 researchers and technicians, and is organized in the form of six organic units. Its R&D budget totaled over 14 billion lire for 1987.

The ING is staffed by a little over 50 persons and its 1987 R&D budget totaled approximately 15 billion lire.

The ENSE [National Selected Seeds Agency], the INBS [National Institute of Game Biology], and the INEA [National Institute of Agrarian Economics] conduct studies and research in the sector agricultural productivity and technologies, with an overall annual budget of some 17 billion lire.

Numbering among the agencies that devote their activities to research oriented on the industrial productivity sector are the IEIGF [Galileo Ferraris Industrial Electrotechnical Institute], the INSEAN [National Institute for Naval Architecture Studies and Testing], the INO [National Institute of Optics], and the INN [National Institute of Nutrition]. And noteworthy among those conducting research in the human health and basic non-oriented research sectors are the Institute of Social Medicine and the Institute of Higher Mathematics, respectively.

Collaboration Between Universities and Enterprises

Collaboration between the universities and enterprises is a prime channel for the diffusion of innovations in the process of formation and consolidation of the scientific and technological wealth of a country.

A survey conducted by the CNR's ISDRS [Institute of Studies on Research and Scientific Documentation], and involving over 800 enterprises selected among those engaged in R&D activities or that in any case can be considered innovators, and over 2,500 members of university faculties, departments and institutes in the science and technology disciplines, found that the role of driving force must be assigned to industry.

By no means secondary is the role being played by the CNR's Targeted Research Projects, in that, on the one hand they have facilitated this collaboration between the universities and the enterprises, and on the other, this collaboration has taken place on medium- to long-range research programs, which are of particular interest from the standpoint of the country's economic system.

As for the role of the CNR, a slight distinction is to be noted in the views of it held by the two operators. In that of the universities, the CNR represents a provider of contributions and financing, and only secondarily a structure designed for the diffusion and transfer of scientific results, technologies and innovations. In that of the enterprises, this order of priorities is inverted, and the CNR is asked by the latter sector to accord primacy to the diffusion and transfer of technologies.

In conclusion, however, this survey finds that the CNR's activity in the innovational diffusion processes involving cooperative relations between the universities and enterprises is considered as being of prime importance by both the interested sectors.

9399

Telettra Participation in Major Italian Research Programs Reviewed

3698m449 Milan RIVISTA TELETTRA REVIEW 42 in Italian No 1, 1988 pp 65-67

[Text] Telettra is taking an active part in European research programs characterized not only by international financing, but above all by the formation of consortia consisting of industries, research laboratories, and universities from the various member nations of the European Community.

Like other Italian industries and organizations, Telettra's interest in participating in these projects is based not so much on financial considerations—in Italy, as in other countries, national financing for research is considerably higher—as on a desire to create an international approach to areas of advanced technology. There are certain specific research projects for which participation in an international program is of strategic importance:

—projects defining the structure and specific functions of new systems, where it is important to be present in order to provide one's own experience on occasions when, to all intents and purposes, new European standards are being created;

—projects in which the complexity of the system and/or the level of sophistication of the technologies employed is such that they cannot be tackled by individual companies or even individual countries.

Of the numerous research programs financed by the European Community (EC), Telettra has focused on two [programs] which are more in keeping with the activity of the company—ESPRIT and RACE—and also participates in other programs, though to a lesser extent.

ESPRIT [European Strategic Program for R&D in Information Technology] is essentially concerned with data processing, microelectronics, and applications systems.

The objective of RACE [Research on Advanced Communications in Europe], on the other hand, is to study the future network of broadband telecommunications in Europe.

ESPRIT has already completed its first 3-year period (ESPRIT I), and phase two (ESPRIT II) is just starting.

In the case of RACE, the definition phase was conducted in 1986, with a 5-year period of project activity, called RACE Main Phase, starting in 1988.

In common with all the EC programs, ESPRIT and RACE suffered delays in 1987 as a result of the difficulties encountered at a political level in reaching an agreement on the EC research budget.

Telettra is also participating in some of the projects in the EUREKA program, which constitutes another major corpus of European projects. Established without either EC financing or regulations, the EUREKA program is particularly flexible and has objectives which are more immediately applicable at industrial level.

On balance, we can say that the work carried out by Telettra in ESPRIT (it is still too early to come to any hard and fast conclusions for RACE and EUREKA) is positive for the following reasons:

—the objectives established in terms of synergies and exchange of know-how have been achieved;

—the collaboration at international level has enabled our researchers (especially the younger ones) to take a less "provincial" approach to their work;

—a relationship of mutual respect and personal friendship has been established between the participants, thus furthering an exchange of opinions and information at all times.

The advantages offered by community funding and by the fact that several companies work on a given project have to some extent been eroded by certain negative aspects, such as:

—inefficiencies because of the distance between the places of work of the participants, requiring travel, meetings, etc.;

—a certain amount of bureaucracy in the system of accounting and reporting to the EC;

—the fact that the various partners in a given project do not always participate on an equal basis.

On the whole, however, the results are definitely positive.

The list which follows gives a brief summary of the projects in which Telettra is taking part, specifying the other partners in the project.

Telettra is participating in four projects in the ESPRIT program; in one of these projects the company acts as main contractor:

—**Project 255** (Advanced Microelectronics): "CAD Methods for Analog GaAs Monolithic IC's [Integrated Circuits]," with Telettra as main contractor; the partners are Siemens (FRG), the Turin Polytechnic, and CISE [Center for Information Studies and Experience] (Italy).

—**Project 986** (Advanced Microelectronics): "Optical Interconnect for VLSI [Very Large Scale Integration] and High Bit-Rate IC's," with GEC (UK) acting as main contractor; the partners are Telettra and the University of Southampton (UK).

—**Project 554** (Advanced Microelectronics): "Submicron CMOS [Complementary Metal Oxide Semiconductor] Technology," with CNET [National Center for Telecommunications Studies] (France) acting as main contractor and other partners. Telettra is taking part in a subprogram in the role of subcontractor for SGS (Italy), together with CNR-LAMEL [National Research Council-Institute of Chemistry and Technology for Electronics Components and Materials) (Italy), Harwell Laboratories (UK), and the University of Aarhus (Denmark).

—**Project 874** (Advanced Information Processing): "Integrated Environment for Reliable Systems." Main contractor: MARI (UK); the partners are Telettra, Jeumont-Schneider (France), and Bologna University (Italy).

In 1986 the RACE Definition Phase was conducted; Telettra took part in four projects within this phase (acting as main contractor in one project):

—**Project 1006:** "Development of a European IBC [Integrated Broadband Communications] Reference Model for the Terminal Environment." The consortium for this project consisted of 30 partners led by GEC (UK).

—**Project 3001:** "Coding: Case Studies." Main contractor: Telettra; partners: ANT (Denmark) and SAT (France).

—**Project 2037:** "Method for Piecewise Development and Construction of Telecommunication Systems." Main contractor: APT (Netherlands); partners: Telettra, TEKADE and TRL (Denmark), DNL (Netherlands), and Philips (France).

—**Project 2039:** "Specification Environment for Communication Software." Main contractor: GSI-TECSI (France); partners: Telettra, CNET (France), CSELT [Center for Telecommunications Research and Laboratories] (Italy), DNL (Netherlands), and IBM (France).

At the end of 1987 the contracts were signed for RACE Main Phase. Telettra is taking part in two projects:

—**R 1044:** "IBC Development and Implementation Strategies." The consortium for the project comprises a large number of participants, both industries and laboratories with links with various PTT's. Some of the EFTA countries are also represented.

—**R 1027:** "Integrated Optoelectronics Towards the Coherent Multichannel IBCN" [Integrated Broadband Communications Network]. Main contractor: STC (UK); partners: Telettra, CSELT (Italy), CNET and Alcatel (France), Athens University (Greece), University of Denmark, and Telefonica (Spain).

The ESPRIT II program will start at the beginning of 1988, and Telettra is currently evaluating the possibility of entering some of the consortia which will submit proposals.

In the EUREKA program, Telettra is collaborating on four projects which have already received formal approval:

—**EU 10:** "Flexible Manufacturing All Optronics." Three major industrial groups—Fiat (Italy), CGE (France), and SMH (Switzerland)—will be taking part in this project. Telettra will contribute as part of the Fiat Group, working on aspects related to communications.

—**EU 45:** "PROMETHEUS" (Program for a European Traffic with Highest Efficiency and Unprecedented Safety). The consortium includes the leading European automobile companies, including Fiat, with Telettra involved as part of the Fiat Group.

—**EU 189:** "Very High Bit-Rate Optical Transmission System." A project on which Telettra, GEC (UK), SAT (France), and ANT (Denmark) will collaborate.

—**EU 229:** "IDEAM" (Integrated Design with Engineering and Automated Manufacturing). The partners of Telettra are: Plessey (UK), CSATA [Center for Studies and Applications in Advanced Technologies] (Italy), and MGZ (Italy).

In conclusion, the most important aspect of the European research programs is the fact that they have offered many European competitors on the markets an opportunity to work together, overcoming the attitude of mistrust and the totally closed approach toward other companies that reigned supreme until a few years ago.

08616

Netherlands Subsidizes Joint Research

36980371a Rijswijk PT/AKTUEEL in Dutch
15 Jun 88 p 4

[Text] Entrepreneurs engaged in joint research can receive subsidies. Minister of Economic Affairs De Korte has reserved 10 million guilders for this purpose in his 1988 budget.

Joint research provides small and midsize companies in particular with insight into new technologies, and at acceptable costs. Despite this advantage, joint research in our country is outdistanced by that in neighboring countries. De Korte hopes to change this situation with the new form of subsidy.

A cooperative arrangement in area of research is considered for a subsidy if it consists of at least six participants that are not part of one group or concern. This type of collective arrangement must act in the form of a nonprofit corporate body, for example as a foundation or association.

The subsidy that these cooperative arrangements can receive amount to no more than 50 percent of the subsidizable project costs. Subsidizable costs are, for example, wages and material expenses for the joint

research project. The maximum amount of subsidy for such a research project is 2.5 million guilders; the total is spread out over the course of no more than 4 years.

In 1987, a number of subsidies were granted to joint research projects; 16 project proposals were given money that year. In one of those projects, "Brick Research, Innovation and Transfer of Know-How," brick manufacturers hope to jointly develop technologies for applications of bricks in the 1990s. Another example is the "High-Temperature Soldering" project of the Dutch Institute for Welding Technology. In this project, the quality and applicability of new metal connecting techniques is being studied. Both should result in a higher level of know-how and a stronger competitive position for Dutch trade and industry.

Applications for subsidies for joint research projects must be received by 16 September, the sooner the better. Information: Information Office of the Minister of Economic Affairs, P.O. Box 20101, 2500 EC The Hague, telephone 070-798820.

12271

SUPERCONDUCTIVITY

FRG: Superconductor Applications Developed

3698M501 Berlin ETZ in German
No 12, Jun 88 pp 554-555

[Article by sb: "Cold Technology With Hot Prospects?"]

[Excerpt]

Cost Factor 'Cooling'

The central point of the investigations up to now has been the question of whether the new materials significantly improve the potential for application of superconductivity or whether such applications can only help bring the idea to fruition. Thus, the following picture emerges: In technical applications with superconductivity as precondition, the relative share of the cooling costs of the total spending is critical. If they represent only a minor part of the total costs, as for example in future nuclear fusion facilities or MHD [magnetohydrodynamic] generators, the new materials will only come into their own against the technically perfected superconductors of the present generation after they have reached a very high degree of technical maturity. But if the cooling costs are a significant factor, such as for particle accelerators, it can be anticipated that the new materials will find widespread use—assuming that they can be sufficiently well processed into technically usable conductors. For all technical applications where superconductor technology is in competition with other highly developed technology, the opportunities for the new technology must be separately evaluated for each individual case. The use of these materials in electronic components and for electrical energy transfer appears highly promising. Studies also indicate that although, according to the present state of knowledge, the simplified cooling technology stands out most immediately as the evaluation criterion for the new high-temperature superconductor, other properties of the new materials can open up application fields, which no one as yet has thought of today. As an example of an application of conventional superconductivity which today is industrially established one could mention nuclear resonance tomography, which 15 years ago was not even the object of such studies.

Utilization Potential for 'Old' and 'New' Superconductors

In order to achieve superconductivity, the superconductors used today in technology, such as the alloys niobium-titanium or $(Ni)_3$tin, must be cooled with liquid helium to about -269°C (4 K). The "new" high-temperature superconductors from rare earths and metals are superconducting "already" at temperatures below -183°C (90 K) and can therefore be cooled with liquid nitrogen (-196°C or 77 K). Meanwhile, material combinations have even been found for which superconductivity sets in as early a -153°C (120 K). For the cooling technology this not only means considerable simplification in construction, but also an established infrastructure for the supply of liquid nitrogen as the cooling medium. The price of the cooling agent in the West European area is a reference point for this: For liquid helium these costs are between DM 15/l and DM 30/l; for liquid nitrogen between DM 0.2/l and DM 0.4/l. In addition to the boundary conditions of the cooling technology, the technology of the superconductor itself naturally also plays a decisive role in evaluating the application potential. Although the new materials are still at a very early stage of development, it is assumed in the investigations that they can be used to produce technical conductors, which in view of the achievable current density and other electrical properties, mechanical behavior and production costs are not a great deal more expensive than the present generation of superconductors already in technical production.

Spectrum of Technical Applications for High-Temperature Superconductors

Among the boundary conditions described above, the studies have so far arrived at the following individual results: Energy technology presents an important application area for the new high-temperature superconductors. It turns out, among other things, that a superconducting power plant generator with a capacity of 1,000 MVA [megawatt amperes] pays for itself when using conventional superconductors just by the saving in electric power loss. The possibility of nitrogen cooling leads to technical simplifications, which increase the marketing chances even more. The same applies to superconducting transformers, for which cost savings of about one-third and weight savings of about a factor of five

appear possible. Control elements such as current limiters, which operate using the transition from superconducting to normal conducting state, or superconducting high-capacity transmission cables also appear attractive—although for the latter the competitive ability to become overhead lines is not yet in the picture.

On the other hand, these aspects of high-temperature superconductors seem less decisive for future energy production technologies: In nuclear fusion reactors with magnetic confinement, as well as for MHD generators, the advantages of nitrogen cooling are not a decisive factor for the usefulness of these power plant systems. Similar reasons also apply to the use of new materials in a magnetic levitation train. The question of whether magnetic levitation trains can even succeed at all and in what areas as compared with the wheel/rail system, is scarcely influenced by the magnetic system and thus by the type of superconductor used.

Another important application area is magnetic tomography, which delivers three-dimensional information from the human body using so-called nuclear spin resonance without using X-rays in the process. At this time it is already one of the most important applications for superconductivity. Here it is expected that the marketing opportunities for magnetic tomographs will continue to grow because of the transition to high-temperature superconductors. Savings of 5 to 10 percent in acquisition costs are conceivable.

Superconductors are needed in thin layers for electronic components. These can already today be produced from the new materials. That is why superconducting electronic components appear to be the fastest technical application that can be achieved with the new high-temperature superconductors. Another important application field is in the area of research. For example, a considerable reduction in operating costs of accelerators, particle detectors, maximum resolution nuclear spin spectrometers and high-capacity microwave generators according to the gyrotron principle seems possible. In addition to the "classic" domains for the application of superconductivity which have been described, high-temperature superconductors may possibly, because of their special properties—for instance in circuit lines with varying strength in different spatial directions—open up application areas, for which today there are not yet any technical conceptions.

11949

Applications for New High Temperature Superconductors Outlined

3698m433 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German
No 479, 13 Jun 88 pp 9-10

[Text] Along with developing technically feasible superconductors, the Institute for Technical Physics at the Nuclear Research Center Karlsruhe (KfK) is involved in assessing applications for these materials. The tests are concerned primarily with the question of whether the new materials can substantially improve the application of superconductivity or serve to promote breakthroughs. The determining factor is the proportion of the total cost represented by cooling. If cooling represents only a minor proportion of the total cost, as in the case of future nuclear fusion plants or magnetohydrodynamic generators, then the new materials can only be more viable than present state-of-the-art semiconductor technology when they have reached a very high degree of technological maturity. If, however, cooling costs represent a considerable proportion of the total, as in the case of particle accelerators, then a wide range of applications for the new materials can be expected, provided that they can be used to produce technically feasible conductors.

In each technical application in which superconductivity is competing with other high technologies, the application potential of the new materials must be assessed separately.

Energy technology will be an important application area for the new high temperature superconductors. For example, a conventional superconductive power generator with an output of 1000 MVA will pay for itself by the savings made in the reduction of power dissipation alone. Nitrogen cooling means technical simplification, thereby increasing market opportunities. This also applies to superconductive transformers, in which case cost reductions of approximately one-third and reductions in weight by a factor of 5 seem possible. Switching elements, such as current limiters, which operate in the transition phase between superconductivity and normal conductivity or superconductive high-power transmission cables—although it cannot yet be envisaged that the latter will be able to compete with overhead lines—also seem attractive. High temperature superconductors will probably play a lesser role, however, in future energy technologies. The advantages of nitrogen cooling do not represent a decisive factor in the feasibility of nuclear fusion reactors with magnetic containment and MHD generators. The same applies to the applications of new materials in the case of magnetic levitation [maglev]. The magnet system and, thus, the type of superconductor used do not have any decisive influence on whether maglevs can replace the conventional wheel and track system.

Another important application is magnetic tomography, which is used to generate three-dimensional information from the human body using nuclear spin resonance and without the use of X-rays. This is already one of the major superconductivity applications. It is to be expected that the transition to high temperature superconductors will be accompanied by an increase in market opportunities for magnetic tomographs. Cost reductions of between 5 and 10 percent seem possible.

Superconductors in the form of thin films are required for electronic components. It is already possible to

produce these using the new materials. Therefore, electronic components appear to be the earliest possible technical application for the new high temperature superconductors.

A further important application is to be found in research. For example, a considerable reduction in operation costs seems possible for accelerators, particle detectors, very high resolution nuclear spin spectrometers and microwave generators working on the gyrotron principle.

Beyond these classical domains for the application of high temperature superconductors, their special properties—for example, their variable conductivity in different directions—could lead to applications which are not yet technically conceivable.

08706

Italy: R&D in Superconducting, Vacuum Metallurgy

Planning for Superconductivity

3698m481 Strese PROCEEDINGS OF THE 10TH NATIONAL CONGRESS ON VACUUM SCIENCE AND TECHNOLOGY in Italian
12-17 Oct 87 pp 130-154

[Article by E. Olzi and F. C. Matacotta, CNR-ITM, Via Induno 10, 20092 Cinisello B., Italy]

[Abstract] The present state of knowledge on recently developed high critical temperature superconductors is reported. After a short review of the characteristics of such materials, the structure and the preparation methods are described, together with the superconducting behavior and the known fundamental parameters.

Precision Casting Techniques

3698m481 Strese PROCEEDINGS OF THE 10TH NATIONAL CONGRESS ON VACUUM SCIENCE AND TECHNOLOGY in Italian
12-17 Oct 87 pp 136-141

[Article by R. Bruno, E. Repetto and S. Matteucci, CSM, Roma, Italy]

[Abstract] Precision casting is currently the most unique method used in the production of complex shapes and alloys that are difficult to work with. In this field, to produce high performance castings, as for example for aeronautics, it is necessary to cast reactive alloys, such as Ti alloys, or high creep resistance Ni superalloys (which contain reactive elements Al, Ti, B, Zr, Hf, Ta). Melting of such materials requires vacuum, which allows a correct composition during melting and casting. The work at hand describes the processes and respective plants used in the production of cast parts, with particular reference to Ni alloy parts for aeronautics with equiaxial structure (turbines, blades, discs), and oriented grain polycrystalline or single crystal components (blades for high performance engines). The CSM is conducting experiments to develop equiaxial casting, using a vacuum induction melting furnace which can handle up to 25 Kg ingots. Future plans include developing oriented grain single crystal components at a new plant under construction.

Instable Valence R&D

3698m481 Strese PROCEEDINGS OF THE 10TH NATIONAL CONGRESS ON VACUUM SCIENCE AND TECHNOLOGY in Italian
12-17 Oct 87 pp 142-145

[Article by G.L. Olcese, Institute of Physical Chemistry, University of Genoa, Italy]

[Abstract] The Institute of Physical Chemistry has systematically worked on Ce and Yb compounds with instable valence for many years. In particular, following research on valence behavior of the two rare earths in binary intermetallic compounds, an investigation was carried out on the anomalous valence phase properties as well as on the valence dependance upon temperature, pressure and the particular kind of partners of the rare earth. The present article details the main results of the research; specifically, the phenomenological properties of the systems are studied by means of structural, magnetic, and calorimetric determinations as well as by photoemission spectroscopy measurements.

Vacuum Annealing of Superconductors

3698m481 Strese PROCEEDINGS OF THE 10TH NATIONAL CONGRESS ON VACUUM SCIENCE AND TECHNOLOGY in Italian
12-17 Oct 87 pp 146-149

[Article by G. A. Costa, M. Ferretti, G. L. Olcese and M. R. Cimberle, Institute of Physical Chemistry, University of Genoa, Italy; G. N. S. M.-C. N. R., Department of Physics, University of Genova, Italy]

[Abstract] Oxygen deficiency, Cu valence state, and superconducting properties were analyzed on $YBa_2Cu_3O_y$ single phase samples prepared with the BaO_2 technique. A gravimetric experiment was performed in vacuum in order to determine the oxygen content in the high T_c superconductor. The oxygen content is strongly affected by the annealing process of the sample, y varying from 7.0 to 5.8 depending on vacuum heat treatment. The tetragonal symmetry (non superconducting) was present in compounds where y is less than or equal to 6.4. The magnetic moment of the orthorhombic phase at the two extreme oxygen concentrations, deduced from the linear fit of the inverse magnetic susceptibility in the 100 divided by 300 K range, are different and consistent with a state of mixed valence of copper. Evidence exists of a critical oxygen concentration of y = 6.8 plus or minus 0.1 for maximum superconducting volume fraction at 77 K.

Low Cycle Fatigue Tests

3698m481 Strese PROCEEDINGS OF THE 10TH NATIONAL CONGRESS ON VACUUM SCIENCE AND TECHNOLOGY in Italian
12-17 Oct 87 pp 150-153

[Article by D. Ranucci and E. Picco, Institute of Materials Technology, C. N. R., Via Induno 10, 20092 Cinisello B., Italy]

[Abstract] Experimental procedures in carrying out high temperature, low cycle fatigue tests with diametrical strain control, under conditions such as vacuum, air, and corrosive environments, are described in this paper. A stainless steel vacuum chamber, designed for a MTS system, made it possible to carry out tests under vacuum conditions consisting of less than 10^{-3}Pa. The results obtained with an IN738 superalloy at 900 degrees C and at two different strain rates $10^{-2}s^{-1}$ and $10^{-3}x^{-1}$ showed that: a) the life expectancy of the sample under stress markedly decreased as the environment became more severe, in sequence from vacuum to air to $NaCl+Na_2SO_4$ deposited layer; and that b) the strain rate effect found in the air and hot corrosion environments disappeared when the tests were conducted in a vacuum of 10^{-3}Pa.

XPS Investigation on Amorphous Silicon Nitride

3698m481 Strese PROCEEDINGS OF THE 10TH NATIONAL CONGRESS ON VACUUM SCIENCE AND TECHNOLOGY in Italian
12-17 Oct 87 pp 154-155

[Article by G. M. Ingo and N. Zacchetti, Center for Materials Development, S. p. A., C. P. 10747, Roma-Eur, Roma, Italy; D. Della Sala, ENIricerche, Monterotondo, Roma, Italy; C. Coluzza, Institute of Physics, University of Rome, La Sapienza, Roma, Italy]

[Abstract] Amorphous silicon nitride a-SiN_x(0 is less than or equal to x is less than or equal to 1.6) thin films, prepared by Dual Ion Beam Sputtering, were investigated by means of high energy resolution XPS. The contribution of Si - $Si_{4-n}N_n$ (n = 0...4) configurations to the total Si2p level was determined. The nitrogen-induced chemical shift and broadening of Si2p core level were evaluated respectively as 0.6 eV and 0.22 eV per attached nitrogen. Artifacts due to Ar-ion sputtering are also discussed.

08800

ADVANCED MATERIALS

Ceramics Facility for Making Chips Established

AU0610125888 East Berlin NEUES DEUTSCHLAND in German 4 Oct 88 p 4

[Summary] Stadtroda (ND)—A new facility for the manufacture of hermetic multilayer ceramic packages for chips started production on Monday [3 October] at the parent company of the ceramics work combine in Hermsdorf. It will fully cover the demand for these components, which are vital to the GDR's microelectronics program. Circuit packages worth DM15 million are to be delivered by the end of the year

COMPUTERS

Hungary Reviews Computer Displays at Leipzig Fair

25020054b Budapest COMPUTERWORLD/SZAMITASTECHNIKA in Hungarian No 8, 20 Apr 88 pp 1, 6

[Article by Attila Kovacs: "Taking the Measure at Leipzig"]

[Text] Where do the socialist countries stand in computer technology? In what areas have they begun to catch up with the developed capitalist countries? How is Robotron doing on its home track and can the others—including ours—come up with products which might be successful in the GDR and other markets? These were the thoughts in my head when I entered the grounds of this year's spring fair in Leipzig under the entry sign formed by a great double M (for "Muster Messe").

Of the 9,600 exhibitors representing 100 countries those got a central place in pavilions 15 and 17 who could be regarded as leaders in microelectronics, informatics and automation, the essential themes for this year's programs. Most of the CEMA countries were drawn up in full armor; virtually every socialist country had new computer products in Leipzig. We could see the greatest progress in the areas of CAD/CAM and data communication. Users could be filled with confidence by the increase in power, compared to earlier versions, of the new ESZR [Uniform Computer Technology System] computers (Elorg, Izot) and supermini computers (Robotron, Videoton)—one to 5.5 million operations per second—and by the appearance of a number of modern peripherals not previously manufactured on the socialist market and by the spread of XT compatible PC's.

There are still "shortage items"—three-D designing programs, high-speed network tools, AT compatible PC's (Videoton is an exception!), large capacity hard disk drives for PC's, high resolution color monitors and graphic control cards, the mouse, built-in high-speed modems, desk-top laser printers, portable or briefcase PC's and a 32-bit, 386 PC.

The Table Spread by the Host

The extensive display of Robotron hid very many surprises. The three most significant were:

—The first 32-bit, discrete processor, multiple workstation supermini computer of the GDR, the RVS K1840, which can be connected by a 9600 bit/s light conducting cable to NC controlled machine tools and PC's. They also demonstrated CAD applications on personal computers connected to a system capable of 1.1 million operations per second with a maximum memory of 16 megabytes.

—The ESZ 1834 personal computer, compatible with the IBM XT, from the software viewpoint.

—A laser printer monster (the ESZ 7230), two meters high, printing 20 A/4 format pages and also equipped with programs.

Robotron's desk thermal printer, unique on the CEMA market, is also worthy of note.

Harald Bornicke, chief of the Robotron office in Hungary, told us that they expect to deliver 200-300 of the XT compatible ESZ 1834 computers to Migert in the second half of the year and next year they will deliver another 500-1,000.

The Dresden Microelectronics Research Center, part of Zeiss Jena, displayed new VLSI circuits; using a 1.5 micrometer technology they are making 256 kilobit DRAM (U 61256) and 64 kilobit SRAM (U 6264) chips. Zeiss also exhibited devices to aid the CAD designing of custom circuits.

It was not by chance that one could find the Videoton stand in pavilion 15, right opposite Robotron. Videoton has been exhibiting regularly here for about 15 years. One is hearing more and more about cooperation between the two competing firms.

Our Stuff

The new pride of the VT line, the R11 Plus megamini computer system, opens up new applications areas—large retrieval and information services, transactional and network database systems—thanks to greater power and better reliability compared to earlier products. In addition to its own PC's they connected Robotron personal computers to the machine (see diagram). The connection was made possible by the new M8 concentrator unit. In this way a maximum of 4 x 32, or 128, PC's can be connected to the megamini over serial asynchronous lines. The central database can be reached by dBASE III and Turbo Pascal programs over 9600 bit/s lines via the network database manager (TTR-NET) of the R11 Plus. A 900 character/s character tape printer appeared here for the first time. The device, designated 23 900, is supplied with an outstanding noise reduction

cover. Export manager Istvan Czondor had more good news: "The printers and computers are sold out. We will put the first R11 Plus into operation in the near future, in Magdeburg. We will install additional systems this year. This year there will be 70 but in the first quarter of next year we will deliver nearly 100 of the 23 900 printers to users in the GDR. During the time of the fair Robotron tested the 'quiet nine-hundreder' in Dresden. We are hoping for another deal in a barter form—we would give our system in exchange for machine tools from WMW."

The latest development from the Datacoop Small Cooperative, the Helios A-11 programmable electronic cash register, can also count on sure market success in the GDR. It could be seen at the Metrimpex stand. The BHG [Beloiannisz Communications Engineering Factory], which has the manufacturing rights, allegedly intends to make 8,000 of these machines this year. The register, also equipped with a light pen barcode reader, can be connected into a PC local network. A Helios, connected into a network with the XT compatible ESZ 1834 of Robotron, will soon be demonstrated here and in the GDR. (The register, which works with a double matrix printer, also automatically calculates the AFA [general turnover tax].)

The 5.25 inch half-height floppy disk drive units of MOM [Hungarian Optical Works] were also out at the fair, and found very strong competitors in the Bulgarian peripherals in the same category also being exhibited.

And Theirs

After that of Robotron the computer stand with the largest area was that of Izotimpex, at which three products seized my attention. The new IZOT 1014E (ESZ 1037) computer system with the associated matrix processor (ESZ 2706) can allegedly perform fast Fourier transformations 500 times faster than the ESZ 1035 used in many places here. The capacity of the closed system fixed magnetic disk subsystem (ESZ 5065)—the disk can be exchanged together with the head movement mechanics—is 635 megabytes. According to the Bulgarians its MTBF is 8,000-10,000 hours. We do not yet have reliability data on the 5.25 inch, 20 megabyte hard disk drive designated SZM 5509.

Elorg represented the Soviets. The attraction at their exhibit was the ESZ 1066 large system which allegedly has an operating speed of 5.5 million operations per second.

The 16 bit minicomputer of the Czech ZVT factory (the M16-22) is a further development of the SZM 50/50 minicomputer. Its multitask operating system is DOS-RV V.3.

With these reports in my bag I left the fair in the confident knowledge that this was the greatest review this year of the socialist manufacturers, and of the domestic ones who appeared here as well.

8984

Computers at Paks Nuclear Power Plant in Hungary

25020054a Budapest
COMPUTERWORLD/SZAMITASTECHNIKA in Hungarian No 8, 20 Apr 88 pp 2, 4

[Article by Huba Bruckner: "Chain Reaction"]

[Text] We have known since Chernobyl that one can deal with nuclear energy only with the greatest responsibility, with fastidiously precise adherence to the prescriptions and with a developed safety system.

Anyone who can visit the Paks Nuclear Power Plant Enterprise and go through the largest complex of buildings in the country housing the four reactors and become acquainted with the work of the power plant can become convinced that those working here know and feel their responsibility. The nuclear power plant now satisfies 40 percent of the electric power needs of the country and the needs of tomorrow can be ensured by putting newer, larger blocks into operation.

From Gate to Reactor

Our editors considered it natural that computers play a major role in the life of the plant. If this is so then we must visit Paks, we thought. And we did. We were not disappointed. They use computers everywhere, from the entry to the dosimetric reading on exiting. We became acquainted with such a broad spectrum of applications that we can only list them in a single report. One application leads to another, a chain reaction is started by acquiring the machines and setting them up. Of course, as in the work of the power plant so in computerization one needs a controlled chain reaction.

With the aid of the magnetic card entry system (the joint work of the Austrians and the Gyor college) one can precisely track who is in the "delicate" areas; in addition to checking authorization this could aid rescue work in case of an accident.

Radiation data is regularly measured in a 30 kilometer zone around the plant. Event data collection throughout the country is done with mobile stations. Naturally the power plant workers are constantly checked at the dosimetry gate. The measurement data are collected and evaluated by computer and various diagrams are prepared from time to time.

The central data collection and process control systems for the individual reactor blocks are computerized. In the first two blocks they still used Soviet devices but in the two newer ones the KFKI [Central Physics Research Institute] provided the computer systems. They are very satisfied with these at Paks.

The ESZ-1055 computer had a part in the initial investment at the power plant; it runs under the OS/VS operating system, handles business and some operational tasks and supports research. At the end of 1985 they also put an ESZ-1045 computer into operation. On the large computers they prepare the scheduling of general overhauls using the PROJACS net planning program package.

In addition to the ESZR [Uniform Computer Technology System] machines an ever increasing role goes to personal computers; with these they can solve individual tasks in the environment of their origin. The work of the Operations and Maintenance Directorate is aided by a Novell net handling 100 terminals and consisting of 13 serving computers.

A graphic technical database is being built up in the Developmental Main Department; technological diagrams can be entered simply with a graphic tablet so the database can be loaded even by those who know little (for the moment) about the computer.

In cooperation with experts from the KFKI and the Nokia factory in Finland workers at the power plant have developed a complete reactor simulator. The work, now being done in Finland, is nearing completion. The Hungarian version represents a much further developed solution of the original Finnish system.

And where there are so many computers many must understand how to use them. So they regularly organize study courses for the power plant workers.

The leaders at Paks are concerned not only about working with clockwork precision and virtually military discipline, they also turn thought to caring for and beautifying the site. They know that foreigners speak with real recognition of the work of the Hungarian power plant. This adds worthily to our prestige.

8984

Hungarian Computer Tech Institute Develops PROLOG Languages

25020054c Budapest
COMPUTERWORLD/SZAMITASTECHNIKA in Hungarian No 8, 20 Apr 88 p 4

[Article by Marton Vargha: "PROLOG... MPROLOG... T-PROLOG... CS-PROLOG"]

[Text] Version 2.2 of MPROLOG has been prepared at the Computer Technology Research Institute and 2.3 will be on the market soon. These new versions represent something new not so much in the language as in the possibilities and convenience of the program development environment.

The PROLOG (PROgramming in LOGic) language appeared at the beginning of the 1970's according to Balint Domolki, scientific director of the SZKI [Computer Technology Research Institute], as a byproduct of research connected with theorem proving programs and as an illustration of their possibilities.

The research started from the idea that if they could develop an automatic theorem prover then all programming tasks could be solved once and for all, because it would only be necessary to write the task in the form: "There exists an object which is the result of the running of the program."

The principle was perfect, but as it turned out it cannot be realized. There are two obstacles. One is that the number of operations necessary to perform logical operations increases not evenly with the complexity of the task but rather exponentially. The other is that formulating the task in the language of logic is often more difficult or at least not substantially easier than developing a program.

The PROLOG defined by the English and French scientists was a part of mathematical logic to which an effective theorem proving procedure—executing mechanism—could be added. The second PROLOG interpreter was made in Hungary, in 1975. At that time research connected with theorem proof was being done at NIMIGUSZI, the Industry Economics and Plant Organization Institute of the Ministry of Heavy Industry, and Peter Szeredi wrote the PROLOG interpreter there in CDL2.

They were dealing with theorem proof and PROLOG in several places in Hungary until finally, in 1978, the theme and many of those dealing with it moved to the SZKI, where the development of MPROLOG began in 1979.

(Those working on the PROLOG theme were: Balint Andrasi, Kalman Balogh, Sandor Barany, Arpad Bedo, Judit Bendl, Mrs Janos Boda, Geza Bogdanffy, Gabor Bolgar, Andras Doman, Tamas Dombovari, Peter Erdei, Zzuszanna Farkas, Ivan Futo, Peter Garami, Eva Janni, Peter Kacsuk, Mrs Zsolt Keresztely, Imre Kilian, Marton Kosa, Gabor Korosi, Peter Koves, Andras Kubovics, Andrea Kun, Tamas Langer, Ilona Losonci, Istvan Marosi, Marta Meszaros, Katalin Mihalyi, Katalin Molnar, Judit Mori, Marta Muller, Imre Papp, Dora Kassai (Mrs Ruttner), Gabor Sandor, Edit Toth (Mrs Santa), Gabriella Solti, Janos Szeredi, Peter Szeredi, Peter Toth, and Gabor Umann.)

In this abbreviation the M stands for Modular, and in a double sense. On the one hand it indicates that the PROLOG interpreter and the developmental environment can be built up of modules according to user needs and on the other hand it indicates that the language can accept parts written in another language—for example in FORTRAN.

This new direction precisely fit into a research plan which the Japanese announced in 1981 and which received the name of fifth generation computers. They gave a great role to PROLOG in this research, although one of the deficiencies of it named by them was precisely the lack of modularity.

In addition to the fifth generation research the significance of logical programming was increasing in the theme of artificial intelligence, which was receiving new impetus. Logical programming is a generally recognized tool for the development of expert systems using a knowledge base, and MPROLOG was a part of a number of such applications by the SZKI.

Another trend in the development of PROLOG was T-PROLOG, also developed in Hungary, which serves the use of logical programming in simulation tasks. The Multilog Limited Liability Company represents this trend; Ivan Futo, a recognized expert on the theme, is its business director. CS-PROLOG (Communicating Sequential PROLOG) was demonstrated at this year's Hannover CeBIT, representing the parallel, multiprocessor, simulation trend. CS-PROLOG differs from MPROLOG in that it is written in C rather than in CDL2.

Since its market introduction in 1982 about 2,000 copies of MPROLOG have been sold world-wide, but the developmental environment for the explosive spread of mini and microcomputer software in recent years—windows and various menu systems—prompted the MPROLOG team to take new steps.

"We transformed the system, originally suitable for line editing and designed primarily for large computer terminals, in accordance with current fashions," said Tamas Langer, who then demonstrated the developmental environment for MPROLOG 2.3 on the Proper-132 personal computer of the SZKI; it's menu structure and screen handling are right up there with the microcomputer systems which can be regarded as the standard in this respect.

Computer technology is developing in the direction formulated in the Japanese fifth generation research plan; there is a need for systems based on knowledge bases which require the least possible computer background expertise from users. Logical programming is an outstanding tool for creating such products, so the future of PROLOG is ensured.

8984

Computer Developments at Hungarian MMG Automation Works

25020054d Budapest
COMPUTERWORLD/SZAMITASTECHNIKA in Hungarian No 8, 20 Apr 88 p 4

[Article by Gitta Takacs: "An Unbroken Process"]

[Text] In 1986, the MMG [Mechanical Measuring Instruments Factory] Automation Works placed first in the profitability ranking of the one hundered largest domestic industrial enterprises (this ranking is based on the net sales receipt proportional enterprise gross profit). The 1987 ranking has not yet been prepared but since the enterprise further increased its production—its sales receipts to 4.15 billion forints and its profit to 977 million forints—it can count on an outstanding position in last year's ranking too. A good number of our industrial enterprises are just now trying to make friends with electronification—the MMG began more than 10 years ago. In 1978 they purchased from an Italian firm the license for a microcomputer based on the Intel 8080 and in 1980 they purchased from another Italian enterprise the license for a microcomputer based on the RCA 1802 microprocessor, but adopting these took a rather long time, because the technological conditions of the firms selling the license and those of the MMG did not always "fit together." The old relay technology survived in the factory until 1980; series manufacture of microprocessor systems started only in 1981. They themselves developed two process control equipment families—the SAM-E process control microcomputer made of Europa card modules and the MP-8501 multiprocessor microcomputer (which works with eight Intel 8085 microprocessors) to solve higher level, central tasks of control systems. At present they make four types of microcomputers, in a series of 400-500 per year.

"We started just in time when, at the end of the 1970's, we turned to the use of electronics in addition to precision engineering devices,"recalled Rudolf Fekete, the director general, about the events of 10 years ago, "undertaking all the human and organizational problems of introducing microprocessor technology and the need for changes in attitudes and thinking."

"For 10 years, beginning at the end of the 1960's, we struggled with fixed wired devices; every single device had to be designed separately, there were no modules, so manufacture could not be efficient or economical enough. Success came with electronification, we had no really serious developmental or manufacturing failure," recalled technical director Istvan Bodor, who quickly knocked on wood.

About two billion of the four billion in sales receipts is system sales, turnkey, process control systems turned over ready to run. Software accounts for 30-40 percent of the value of these. Not counting the base software, a software team of 35-40 people does all the programming work. They developed their own software manufacturing technology over the years, expanding the assortment of program modules which can be built in in many places. The software development environment was transformed in 1987 too—they switched from the Intel MDS, SAM, SZM-4 and ESZ-1010 machines that they used earlier to IBM compatible PC's. The "PC density" is one computer for every two software developers, with four people per computer in the hardware design shop.

They cooperate with a number of branch planning institutes (VEIKI, Olajterv, Eroterv, the MAV Planning Institute) and university and research institute development groups in developing the process control systems

and putting them into operation. As reference sites for their work they can list the control technology for about 150 oil tank systems in the socialist countries, a number of compressor stations (in the Soviet Union, for example, they tied 150 microcomputers into a hierarchical system to control a petroleum pipeline 3,000 kilometers long), the process control microcomputers of domestic alumina factories and power supply enterprises, the microcomputer data collection system of the Paks Nuclear Power Plant and participation in design of the control system for the 1,000 megawatt Paks power plant block starting up in 1995.

As for the money necessary for investments, talks are under way concerning a technology development World Bank credit package. They are taking the first steps at the MMG to introduce CAD and CAM. They are getting acquainted with PC CAD software and are introducing a computerized quality control line. But creating a single computerized circuit designing workstation costs 4.6 million forints and equipping one mechanical designing workstation costs 5.5 million forints. They will surely buy the one in 1988, but they will buy the other too if the credit talks go well.

The equipment of the MMG Automation Works—more precisely, the modernness, quality, etc. of it—determines the culture and operating environment of quite a few domestic industrial branches, from the chemical industry through power supply to thermal power plants, water works and gas line systems. To give just one little example, in 1985 at the Capital Water Works the MMG turned over a microprocessor system to monitor the production of the wells and the distribution of water. As a result—taking other measures into account too—there has been no water shortage in Budapest for two years.

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Hungary: Discussion of Self-Developed Program for IC Production

25020054e Budapest
COMPUTERWORLD/SZAMITASTECHNIKA in Hungarian No 8, 20 Apr 88 p 8

[Letter from Laszlo Szalai, electronic instrument worker, Budapest, to the editors]

[Text] In your issue for 27 January 1988, an article titled "BOAK [equipment oriented circuits, custom circuits]—Let Us Talk About It!" states that here also there are personal computer systems which make it possible for the user to design his integrated circuits himself.

Last year we developed for our own use a program system to design integrated circuits which proved itself to us. The PC GAELIC V 1.1 conversational graphics system makes it possible to design and display integrated circuit location drawings, modify them in the conversational mode and prepare a generator control tape to make the masks for the individual technological layers. With its aid one can also design new, applications oriented integrated circuits based on a cell library.

The designing system runs on an IBM PC/XT or AT or compatible computer with 512 kilobytes central memory in a floppy or fixed disk configuration; it handles a color graphics screen and printer. Test drawings can be made with the aid of a plotter too.

Our product is based on the internationally widespread GAELIC mask description language, also used in Hungary. The basic elements of the language are lines, polygons, rectangles, wires of prescribed width and text, which can be placed on various layers. From these basic elements one can make cells within which previously defined cells can be placed. Thus the design for the integrated circuit mask can be built up from parts in a hierarchic manner. Another advantage of the GAELIC language is that the plans prepared can also be used by other designing systems.

The designer works on a graphic screen with a menu system. The program prepares selected layers of the finished integrated circuit drawing for pattern generation (it produces a description of the layer from the hierarchic description) and covers the forms with rectangular blocks.

Thus far we have used about 8,000 equipment oriented integrated circuits, entirely of our own design, in equipment we have developed, but we would be glad to be of service to others as well.

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Hungarian Software Export to Capitalist Customers Analyzed

25020054f Budapest
COMPUTERWORLD/SZAMITASTECHNIKA in Hungarian No 8, 20 Apr 88 p 9

[Article by Peter Broczko: "Our Capitalist Software Export"]

[Text] By the second half of the 1980's, Hungarian software export, a virtually negligible factor in the 1970's, had become an increasingly more determining part of our intellectual export. In our article we analyze by category the advantages and disadvantages of software export. We conclude a sketch of the present situation with suggestions to aid future development.

Our capitalist software export has three chief forms: export of manpower (common), project export (rare) and product export (most rare).

Manpower Export

Let us examine the manpower export by participants! The people going out can become acquainted with modern tools and methods and can constantly perfect their language knowledge. They build up market contacts. Going out is favorable for them materially, and they can do so even more advantageously if they buy for their saved wages developed technology, often embargoed, and sell it here at home (we now ignore the ill founded measures—surely temporary—which went into effect on 15 January 1988). So they can exploit two increases in value when crossing the western border—manpower increases in value going west, hardware does so going east. The younger age group is most interested in working abroad. This is extraordinarily favorable for them; it makes it possible to establish a material base for starting independent life. Fitting into a new environment is easier too, they accept better their possible lack of experience than, for example, an expert of middle age. In the case of the latter the absence from family holds them back too (family travel is rare). And their professional tasks—although done with modern technology and methods—are often at the level of helpers trained on the job (for example the "ton writing" of spreadsheets) so many of them call this sort of export work a "slave trade."

Because of language and professional restrictions a relatively stable staff of 400-500 persons participate in domestic manpower export and, as we shall see, replacements for them are not ensured at this time.

From the viewpoint of the enterprise which sends them accounting for manpower export is free of problems and is guaranteed to be profitable. But the supply of experts which can be sent is small. Only a few have the necessary language knowledge, which is a good indication of the low effectiveness of our foreign language instruction in recent decades. Beginning in 1988, in order to improve the level of language knowledge, the SZAMALK [Computer Technology Applications Enterprise] is starting a course for computer experts preparing for work abroad; in addition to language they will study the general culture there, thus facilitating their fitting in there.

In our country the large firms can rear a highly qualified, experienced labor force worthy of export—but it is very expensive. These firms, however, cannot pay their marketable experts as they would like, given the present regulator system. Other economic organizations, primarily small undertakings, can pay good experts two to four times as much as the large enterprises which educated them. So one cannot morally condemn those who, with present prices, change jobs for many times the pay. And in the case of capitalist manpower export the "Western business" goes to the worker who changes jobs too—it makes no difference to the foreign employer what "hat" is being worn by a good expert well known to him. This process is dangerous because under the ever more difficult economic conditions the patronage activity at the large firms is becoming paralysed, and there will be no expert replacements for the manpower export. As a result it is stagnating, and our software export will decline as the present, relatively stable export staff wears out.

At present the firms sending out manpower appear on the capitalist markets as competitors of one another. Often they undercut each other's prices, take work from one another. These facts certainly demand more organized market work and more united market action.

Hungarian manpower is advantageous for the Western receiving firms because they get extraordinarily broadly trained experts at a relatively low price. It must be emphasized that there is unemployment in the West among computer experts with general training, so only highly qualified, specially trained experts can be part of the manpower export. Even the latter must face not only the expert competition of the receiving country but also the experts coming from developing countries. Since 1986 all of West Europe has been flooded with young workers (primarily Indians) from third world countries, highly trained at universities in the United States or Great Britain who speak English perfectly, and they are looking for work at incredibly low prices. Spanish experts have appeared in increasing numbers too.

Project Export

Exporting entire projects is rare in our country. It is difficult to estimate the expected work and cost volume but a low price is one of the basic conditions for winning a competition; and there are no reserves here. For these reasons project export is often a losing proposition, so domestic firms—understandably—deal with this theme very cautiously.

Product Export

Although product export is the most rare within software export logic would require that this be the most common; the total cost (manpower, etc.) appears at the domestic, relatively low price level, in forints, so a product with low production costs could be sold for foreign exchange at the good bit higher Western price level.

The key to the apparent contradiction is that expensive marketing is needed to introduce the products on the Western market—because of the sharp market competition there. It was an actual experience of a domestic firm that marketing costs of 300,000-400,000 marks accompanied a profit of 100,000 marks. Another practical experience was that the cheaper the software product the greater the marketing expenditure needed to introduce it. For example, introducing software costing 400-500 marks requires marketing costs on the order of a million marks.

In order to eliminate these disadvantages we should avoid the main players (for example, database development) and concentrate on the market gaps. A good practical example of this is the business success of Graphisoft (graphics) and Compudrug (chemicals) on capitalist markets.

Summing Up

It can be seen from this review that our software export, still flourishing, is threatened by many dangers and the survival of the present situation could lead to a decline.

Development is affected unfavorably by the high tax levied on intellectual activity beginning in 1988; those who produce software export make a high income so the progressive character of the tax weighs more on them. Since income made in this way is very favorable for the national economy it would be justified to have concessionary taxation on those working for software export.

The outmoded restrictions of the customs regulations have been narrowing for years the sphere of experts who can be drawn into software export; for a long time it should have been made possible for travelers to bring in IBM PC compatible microcomputers for their own use—with concessionary duty tariffs as for VHS video players. The price of these has fallen to a level attainable even by tourists. This modification is actually too late, because beginning in 1986 the market for software products intended for IBM PC compatible machines was oversaturated in the developed Western countries. So the developers and product demand have begun to shift in the direction of the more powerful, 32 bit machines (for example, VAX), so PC knowledge in itself is no longer really marketable or really modern. So the world marches on, only our customs regulations remain. It would be good to draw the lessons of this case and finally make technical development administratively possible, for the long term—at least for individuals.

It would mean much if the material incentive for exporters were to change so that organizations exporting software were to get foreign exchange in return. Then they could use this as they saw fit, for marketing, to introduce products or to acquire modern hardware and software tools. The latter is an absolute precondition for staying on the market. By continuing the present situation, because of the difficulties in getting tools, even the present software exporters will unavoidably be forced from the Western markets.

A mixed enterprise formed with Western firms is a realistic way out of this self-destructive cycle. At present however this is such a prolonged and bureaucratic process as to be alarming. For example, the Rair Limited Liability Company formed in November 1987 requested authorization in 1985.

It might represent further progress in changing the structure of our software export—that is, in bringing project and product export into the foreground—if local offices were opened in the West. The operation of these and the guarantee of direct contact through them would inspire confidence in foreign purchasers. The representation offices might also play an important role in that the Hungarian firms would not compete with one another out there but rather appear on the capitalist markets unitedly, supporting one another and supplementing each other's services.

Non-ruble Accounting Technical Intellectual Export and Software Export

	1983	1984	1985	1986	1987*
Software export (million forints)	154	267	385	578	700
Technical intellectual export (million forints)	1,181	1,241	1,861	1,589	1,600
Share of software export (percentage)	13.0	21.5	20.6	36.4	37.5

*)Estimated

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Hungary's Csepel Computer Section Receives Robotron ES 1057

25020063a Budapest COMPUTERWORLD/SZAMITASTECHNIKA in Hungarian No 13, 39 Jun 88 p 2

[Article by Huba Bruckner: "1,500 Percent"]

[Text] Large computers are rarely installed in our country today, and there probably has never been an example of Hungary being the first foreign customer for a new model. If we add that the computer in question is the currently most powerful member of the ESZR [Uniform Computer Technology System] family, then this is one for the record book.

We are happy to report that in the first days of June a Robotron ES 1057 was handed over at the Computer Technology Enterprise of the Csepel Works. The leaders of the enterprise make no secret of the fact that they decided on this model after many sleepless nights, for they knew that they were buying a device which is considered entirely new even in the GDR. But they regard the long-term cooperation agreement signed with the firm as a guarantee for the future as well. All the more so because of the foreign ESZR products the products of Robotron are the most reliable, and the vendor in the GDR regards the Csepel installation as a reference site.

It is a fact that events moved with record speed in the history of socialist computer trade and so it could be that the ES 1057, serial number 004, was handed over within weeks of signing the delivery agreement at the Budapest International Fair.

Well Founded Development

The Csepel Works was one of the first Hungarian industrial enterprises to begin building up computerized production control systems. A Control and Computer Technology Institute was established in 1967 to modernize the control system for the enterprises; its first computer was an Elliott 4100. The machine park was expanded by an ICL System 4-52 in 1973 and by two ES 1022's in 1978.

The ES 1022's created the technical foundation for building larger databanks and introducing remote data processing. The explosive spread of personal computers began at Csepel in the 1980's. This increased the demand for networks. The large computer systems which had been "tuned" primarily for batched processing were holding back development, for with the spread of applications there were larger and larger files and the need for distributed systems increased.

So acquisition of the ES 1057 was urged not by an upper but rather by an internal requirement. The task of the new machine will be integration of the current applications systems, a rational unification of the large computer and microcomputer services, and creation of the central resource and data sources necessary for this. The new machine will certainly be capable of this for its computing capacity is about 15 times that of the existing machines. But the increased capacity may also give a push to the imagination of the developers.

When choosing the model, one of the primary considerations was reliability, for one cannot imagine serious production control and remote data processing with tools which sometimes work and sometimes don't. The people at Csepel hope for the same reliability from the magnetic disk background stores coming from the SZAMALK. Their decision in selecting the system was strengthened by the fact that both the computer and the magnetic disks are IBM compatible, which not only makes possible the transfer of existing systems virtually without restriction but also makes possible use of the most modern operational and production control programs.

In the Longer Run

The experts of the triad—Robotron, SZAMALK and the Csepel Works—did fast and good work. When they cut the ribbon with national colors decorating the two-screen console of the ES 1057 a really operable system passed to its Hungarian owners. The people at Csepel undertook to help, as reference users, a search for those possibilities and needs which might bring new Hungarian markets for Robotron. In addition they will participate in broadening the applications areas for the machine, among other things in the development of transaction oriented uses and in expanding the network system (including use of microwave data transmission lines) and they plan to fit it to additional computer technology devices. Within the framework of long-range cooperation the Computer Technology Enterprise of the Csepel Works has gotten the computer on very favorable terms.

And there are already several interested domestic parties who will need similarly large capacity increases to carry out their tasks. It is very essential for them how things go at Csepel. If the machine "ticks along" doing intelligent work perhaps they too will be more cheerful.

Bare Facts

In addition to the new tools for the ES 1057 system put into operation they will be using some equipment from the earlier machine park.

The estimated speed of the twin processor ES 2157 central unit is (on the basis of the Gibson-3-E mix) 1.6 million operations per second. (The result of the Gibson test in the one processor version was 1 million operations per second; on the basis of this they estimate the power of the two processor version.)

The cycle time of the clock signal is 216 ns.

The capacity of the operational memory is 16 megabytes. (For comparison, the operational speed of the ES 1022 machines is 110,000 operations per second and their memory capacity is 1 megabyte.)

The number of channels is five (of these two are byte multiplex and three are block multiplex) and their typical transmission speed is 1.8-3 megabytes per second.

The tape units have a variable writing density of 800 or 1,600 bits per inch, with a transmission speed of 180,000 bytes per second.

The total capacity of the magnetic disk subsystem delivered by SZAMALK is 5 gigabytes.

They have (or will) connect to the system the two printers already in the machine park, the 2 x 6 disk Memorex storage systems and the IBM 3704 remote data processing control.

At present they will operate 12 near and 5 distant terminals; the number of these can be significantly expanded depending on need.

The operating system used is SVS 7.1 under VM 3.3, but they will soon convert to an SVS 7.2 version under VM 3.5. (According to Robotron sources—and domestic experts confirm this—the SVS 7.2 developed by the GDR is 60 percent faster than its IBM counterpart.)

"Live use" of the new operating system versions is one of the points of the cooperation between SZAMALK and Robotron.

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Director of Hungary's Computer Institute Interviewed on Control Trends

25020063b Budapest
COMPUTERWORLD/SZAMITASTECHNIKA in Hungarian No 13, 29 Jun 88 pp 9-10

[Interview with Academician Laszlo Keviczky, director of the Computer Technology and Automation Institute of the Hungarian Academy of Sciences, MTA SZTAKI, and chairman of the Applications Work Committee of the International Federation of Automatic Control, IFAC, by Szilard Szabo: "Control of the Future"]

[Excerpt] COMPUTERWORLD/SZAMITASTECHNIKA: What are those areas in which the greatest ferment is seen today? Are there "fashionable themes" in the good sense of the word?

Laszlo Keviczky: In my judgment we should stress eight research trends which seem to have prospects. By title these are linear systems, design of control, robust (insensitive) and adaptive control, control of systems with distributed parameters, process and system identification, nonlinear control, computer technology and the theory of VLSI circuit applications and finally nonlinear filtering and control. Although these themes stand in the center of the interest of researchers the experts have judged that the results of the last 3 years of research have only enriched our knowledge and we cannot talk of any new, revolutionary discoveries.

COMPUTERWORLD/SZAMITASTECHNICA: In the Applications Work Committee of IFAC, led by you, the most significant manufacturers and system installers of control systems and automatic elements are represented. Many say that the experience and opinion of practical experts are at least as important as those of theoretical researchers. How do they see the tasks awaiting solution?

Laszlo Keviczky: In the work group dealing with electric power systems, for example, what they considered most important was distributed, real-time, open architecture computerized control. They discussed such questions as completely graphic, color, raster display and the man-machine link, and active and reactive power distribution and scheduling. There was talk of optimizing preventive control, of linear and nonlinear control methods, of operator training simulators and use of expert systems. The evaluation by the work group found little chance for use of expert systems in the area of energy systems. They considered the automation of dynamic safety control strategies regarding dangerous situations and restoration periods to be a still unsolved problem. Domestic R and D activity and to a certain extent our industrial applications also reflect the international forecasts and predictions.

COMPUTERWORLD/SZAMITASTECHNICA: This sounds rather diplomatic. Seeing the backwardness of Hungarian industry, the question arises whether the above statement represents only the desires and hopes of a researcher. How do you see the situation of domestic control technology and automation?

Spitting Into the Clouds!

Laszlo Keviczky: We have said many times that it is very difficult to realize technical development in an economy where human work is underpaid and automation is very expensive. Resolving this conflict would require development of a national science policy and instrument development strategy, but this exists only at the level of a declaration. I feel that one of the most serious problems is that a domestically developed technology on which automation could be "mounted" hardly exists. The general industrial practice is that the enterprises buy machines, or in a good case turnkey systems, and use them without any further development. So in many cases not even the conditions for simple renewed production exist.

For a long time the domestic computer industry counted as an exception. SZTAKI worked on the development of integrated manufacturing systems and CIM techniques. Many said that we had broken with reality and called us "cloud lickers" or imitators of the Chinese great leap.

COMPUTERWORLD/SZAMITASTECHNICA: Surely the reduction in state support for research institutes has made the situation of SZTAKI more difficult. What effect has all this had on your everyday work?

Laszlo Keviczky: We are in virtually a schizophrenic position. Being an Academy institute we should deal primarily with basic research. Our foreign visitors do not understand why we take on so many applications jobs. We do not do it out of good will—we have to live on something. State support covers 15-20 percent of our budget. To be able to deal with basic research this ratio should reach 40-60 percent. I would not consider it good if it were more, because then we would be divorced from the real needs of industry and our research would take on an "aristocratic" character.

For the time being this danger does not threaten, for the money turned to research is less and less. Of the 30,000 Hungarian researchers only 3,000 work in Academy institutes. If we compare this to the number of workers working in KISZ, the trade unions and various apparatuses then 3,000 is not really very significant. There is a burning need for the accumulation of knowledge, our entire civilization is based on it. But domestic research and development has been forced into defensive positions. Even health affairs and education policy—in a bad situation themselves—have stronger spokesmen than natural science and technical research.

COMPUTERWORLD/SZAMITASTECHNICA: Whimpering was always far from researcher mentality. What sort of solution possibilities do you see in spite of the undoubtedly difficult situation? Surely SZTAKI has its own strategy.

Laszlo Keviczky: Progress could be made in two areas. On the one hand we must automate the technologies bought from abroad and on the other hand we must develop systems of a complexity which it would be impossible to create in a small undertaking. I cannot emphasize enough that technology is the basis for everything. We have achieved the most significant successes where this was given. An example is the lamp manufacturing line of Tungsram.

The industrial leaders here rarely have the sort of courage we saw at the Paks Nuclear Power Plant. There there was enough moral strength to supply the Soviet technology with automatic equipment we developed ourselves.

Hungarian Lobby?

COMPUTERWORLD/SZAMITASTECHNICA: After the domestic problems let us return to the "ethereal" world of science! There are traditionally many Hungarian researchers in the leadership of IFAC. In the preceding period (1984-87) Tibor Vamos was president of IFAC and Gusztav Hencsey was secretary. Most recently they elected Janos Gertler chairman of the Publications Committee and Laszlo Nemes chairman of the Machine Industry Automation Work Group. And you are chairman of the Applications Work Committee for the second time. To what can we attribute this worthy list of names?

Laszlo Keviczky: It seems obvious to say that we attribute it to professional prestige.... Naturally there are certain criteria in scientific life on the basis of which the professional rank of a person can be measured. These might be, for example, a role in conferences, the number of publications or the citation index. This is important in filling an office, but it is not the only factor. A number of factors are weighed by international bodies; they try to represent the interests of countries with different social systems and different geographical locations. For example the organization has a Soviet president in the person of Academician Boris Tamm, but it has been decided already that his successor will be an Australian professor. But there is no doubt that Hungarians, including those working at SZTAKI, participate in the IFAC leadership in a far greater ratio than the population, gross national product or number of researchers of the country would justify. All this is a great success of Hungarian science policy. It is characteristic that they elected Tibor Vamos "Life Consultant."

COMPUTERWORLD/SZAMITASTECHNICA: Do you, as chairman of the Applications Work Committee, get professional information about which a simple participant at the conference is not informed?

Laszlo Keviczky: Certainly, but let me say that this is not the essential thing. Science has its own laws. Every researcher yearns to be in the front rank, to be informed in time about the most important achievements, to see and feel and if possible to form the international trends of research, and naturally to try to be the first to make these achievements accessible for domestic use, whether we are talking about education, research or technical development.

Siemens Research

COMPUTERWORLD/SZAMITASTECHNICA: It is well known that the large world firms dictate the direction and tempo of research. Can one, at the international conferences, follow the most important elements of the research and development strategy of such monopolies as, for example, Siemens?

Laszlo Keviczky: Naturally. For example, one of the leading researchers of Siemens, Peter Ernst, reported—at the most recent meeting of the IFAC work committees—about how his enterprise regards environmental protection, among other things, as an especially important task. To a significant degree they are putting automation research and development work into the service of this and are turning a lot of money and intellectual effort to reducing to a third of the present value the sulphur release of industrial plants in the FRG, Holland and Austria by the end of 1988. Naturally they are not doing this out of philanthropic considerations. As a result of the environmental protection movement the power plants face extraordinarily heavy fines unless they take radical steps to reduce air pollution. The experience of Siemens has shown that the entire arsenal of applied control technology will have to be deployed to solve these tasks.

The German researchers expect in the years ahead a great development in the area of new type shipping and transportation systems, for example high speed air cushion and magnetic float techniques.

We should make special mention of the question of managing machine manufacture among nations. A good example of this is that they were able to develop the "just-in-time" system for the Western European Airbus project.

Comprehension Instead of Conversation

COMPUTERWORLD/SZAMITASTECHNICA: What news was there in the area of communication and networks?

Laszlo Keviczky: We must emphasize three important traits of the Siemens research policy. First, the leaders of the large enterprise definitely reject ad hoc communications systems and have cast their lot for adherence to international standards. In the area of communications

solutions they place the emphasis on "comprehension" as compared to "conversation" communication, if I want to express the professional essence in simple words.

They attribute especially great significance to the automation of mechanical processes. This has been forced very much into the background in Hungary. It is worthy of note what an important role in the developmental successes of Siemens has been played by, for example, the use of special bearings and special mechatronic solutions.

From the viewpoint of the automation of intellectual processes one of the fashionable themes is a high level man-machine link. The "windows on the process" approach represents a very real change compared to the traditional man-machine link.

COMPUTERWORLD/SZAMITASTECHNICA: In addition to (and increasingly before) the United States and West Europe the world is paying attention to Japan. What news was reported there?

Laszlo Keviczky: In his plenary address Professor Narita analyzed the relationship between information technology and the control of systems. He noted that for a long time it was falsely believed that information technology could be used primarily in planning checking and execution. Today it is the general opinion that information technology is penetrating every area. Analyses show that instead of the earlier central control the emphasis is increasingly on distributed control. Development is progressing in the direction of integrated systems. Although this recognition does not count as news we are still far from actual realization. Experts predict a great future for digital signal processing, image processing and intelligent information processing.

COMPUTERWORLD/SZAMITASTECHNICA: The results of control technology research—often difficult to follow for an outsider—can be more easily understood on seeing some special application. Surely you have some especially interesting experience in your bag.

Laszlo Keviczky: When I visited Minneapolis I went to the top floor of a skyscraper on a very windy day. I found to my surprise that the sway of the building was not so great as one might have calculated. In response to my question they said that the tower was "balanced" by a computerized automatic device. How is this possible? There is a method widely used in military applications but still a curiosity in civilian applications where the sway of an object is "absorbed" with the aid of a body turning at high speed. This is a most dangerous operation because the mass centers of the turning body must be positioned very precisely and the speed of the rotation must be set very precisely. In the case of the Minneapolis skyscraper these values are controlled by a very high precision automatic device, as a function of the sensed wind direction and speed.

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